SCIENCE

[Entered at the Post-Office of New York, N.Y., as Second-Class Matter.]

A WEEKLY NEWSPAPER OF ALL THE ARTS AND SCIENCES.

SEVENTH YEAR.
VOL. XIII. NO. 327.

NEW YORK, MAY 10, 1889.

SINGLE COPIES, TEN CENTS.
$3.50 PER YEAR, IN ADVANCE.

THE WESTERN ELECTRIC INCANDESCENT LIGHTING SYSTEM.

ALTHOUGH it has not the capacity of the arc system for producing large lights, and is inferior to it in economy, the incandescent light demonstrates daily its ability to compete successfully with gas and other systems of lighting, and has supplanted gas for purposes of general illumination in many places.

Figs. 1 and 2 illustrate a complete dynamo as made for the incandescent system of the Western Electric Company, while Fig. 3 shows a field-magnet and pole-pieces only. The whole iron base is cast in one piece. The cores of the field-magnets are made of soft iron, and pole-pieces are cast upon the upper ends of the cores. The lower ends of the cores are bolted to the cast-iron base: there are therefore only two magnetic joints in the whole system.

The type of field-magnet frame used in their well-known arc-lighting system is not used for this incandescent apparatus; but a simpler form, and one better adapted to this class of work, has been adopted. The peculiar form of the cast-iron base results in bringing the armature-shaft at a convenient height from the floor, but not so high as is usually the case in dynamos having this type of field-magnet, while at the same time it permits the use of the sliding carriage for adjusting belt-tension without raising the dynamo or rendering it unstable. The field-magnet coils are con-

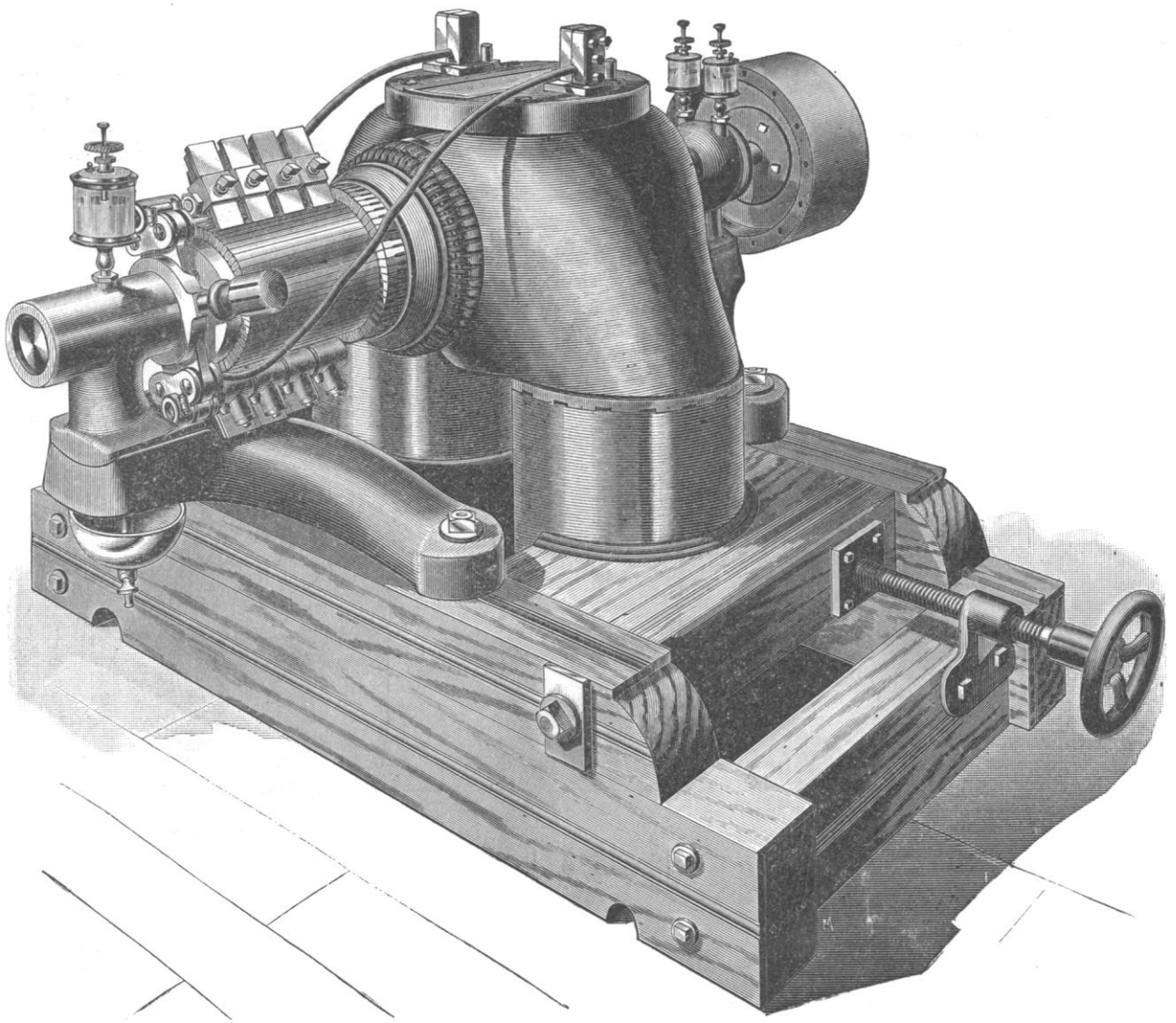


FIG. 1.—END VIEW OF INCANDESCENT DYNAMO OF WESTERN ELECTRIC COMPANY.

nected, shunting the armature. The automatic regulation thus secured is practically perfect. Any number of lamps may be cut in or out without visibly affecting the candle-power or brilliancy of the lamps throughout the system.

The terminals of the thin field-wires are not exposed to injuries, as in so many systems, but are led in channels through the pole-pieces to the field binding-posts. Both these posts and the main binding-posts are mounted on a hard-wood board, which is secured on the top of the pole-pieces. This board has an oblong slot covered with wire gauze, allowing the warm air from the armature to ascend, and at the same time preventing any thing from falling on the armature. The armature is of the drum type, and is wound in a very simple and peculiar way, avoiding all joints in the wires but two. The commutator is very massive, and will last for many years. From two to six sets of brushes, according to the size of the dynamo, carry the current from the commutator to the cables without the least heating or sparking, — a fault so common in many other systems.

Although the dynamo is automatic in its action, a variation in the speed of the engine or water-wheel might cause the lamps to burn above or below candle-power. An instrument is therefore needed to indicate at all times to the engineer or dynamo-tender whether the lamps burn at normal candle-power, or, what is practically the same, at normal electrical pressure. The voltmeter (Fig. 4) used for this purpose is simple in construction, dead beat, and may be left in the circuit permanently without overheating. It needs no recalibration, as it has no permanent magnets, and is considered reliable.

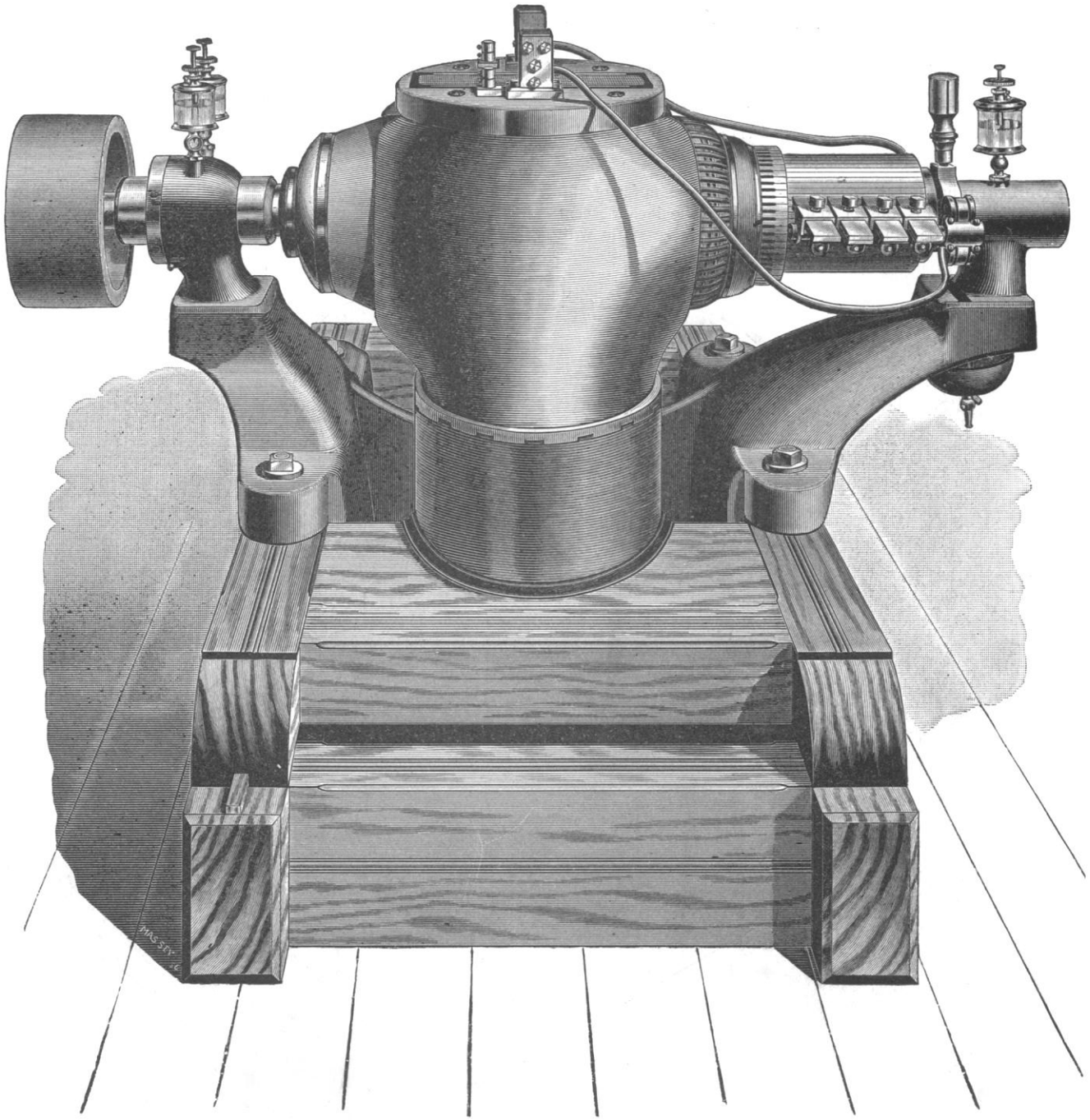


FIG. 2. — NEW INCANDESCENT DYNAMO OF THE WESTERN ELECTRIC COMPANY.

The rheostat or hand-regulator (Fig. 5), used to keep the electrical pressure constant by increasing or decreasing the strength of the field, is non-combustible. It consists of a cast-iron frame provided with porcelain insulators, to which german-silver wire coils

FIG. 3.

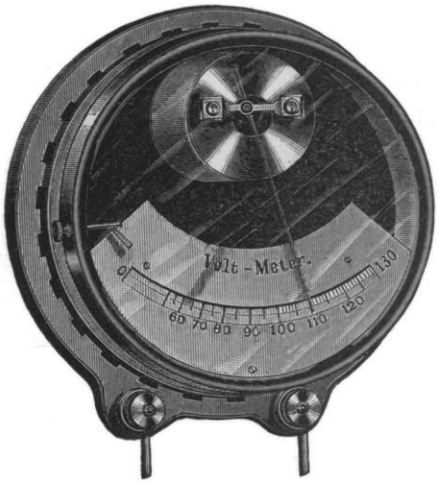


FIG. 4.

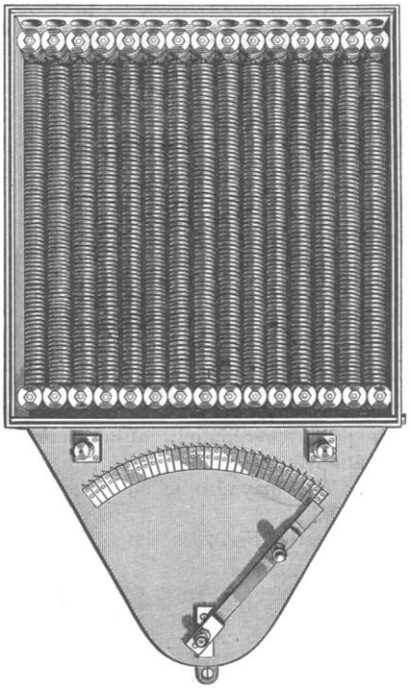


FIG. 5.

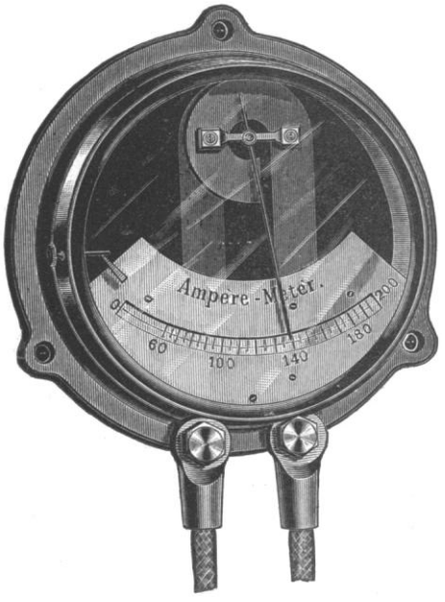


FIG. 6.

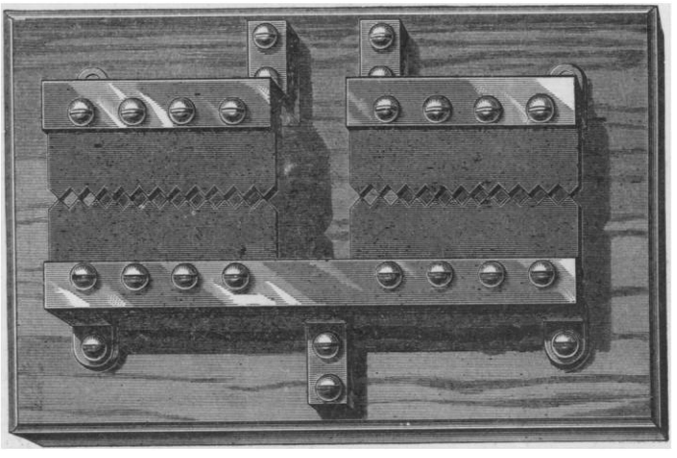


FIG. 7.

are attached. The front of the rheostat-box is covered with glass, preventing the dirt and dust from getting into the box, and at the same time allowing ready inspection.

The ampère-meter, or ammeter (Fig. 6), is an instrument to indicate the number of ampères which the dynamo is generating

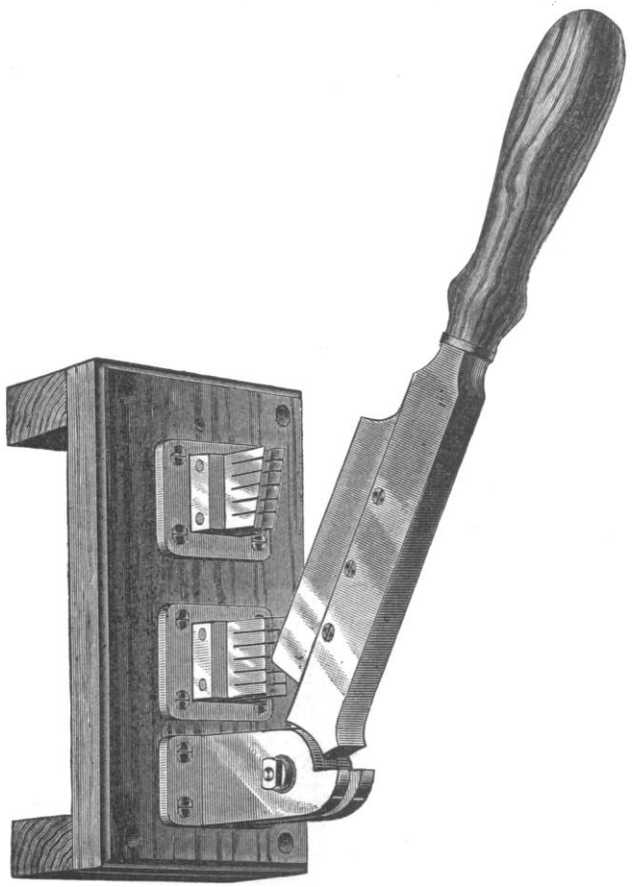


FIG. 8.

As each lamp requires a certain current in ampères, from the indications of the ammeter, the number of lamps burning may be easily computed. This may also be left in the circuit permanently without overheating.

The lightning-arrester (Fig. 7) is simple in its operation. The jaws of this lightning-arrester are made of carbon plates. In case the dynamo-current should follow a discharge of atmospheric electricity, an arc may be set up; but this will burn away some of the carbon points, and thus free the dynamo of the short circuit. Such a carbon lightning-arrester can, of course, only be used for low-tension dynamos.

Fig. 8 represents a main switch of the Western system for 150 and 300 ampères capacity.

Fig. 9 represents a multiple safety cut-out board. These boards are convenient where a number of branches terminate in a closet, and are useful to connect up a number of single cut-outs in multiple arc. These boards are made for any number of circuits from four to twelve. The safety-strips may be replaced in a few seconds, and, while current is on, without danger.

FIG. 10.

Figs. 10 and 11 represent ceiling cut-outs, to be used when lamps are to be suspended by means of flexible cable.

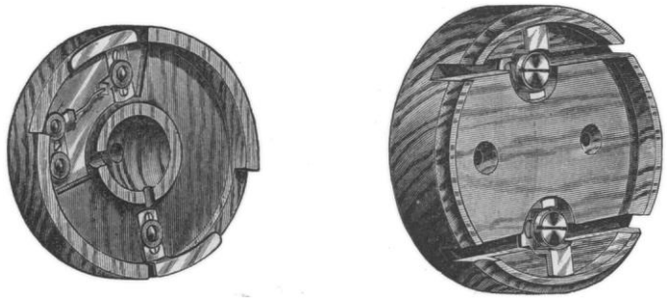


FIG. 11.

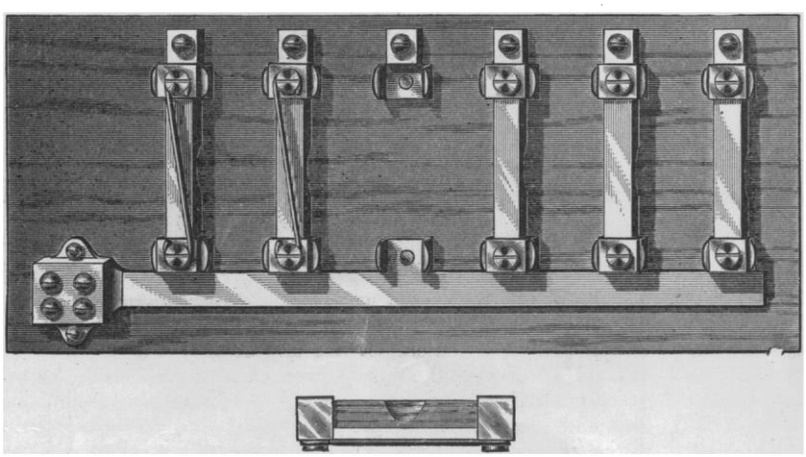


FIG. 9.

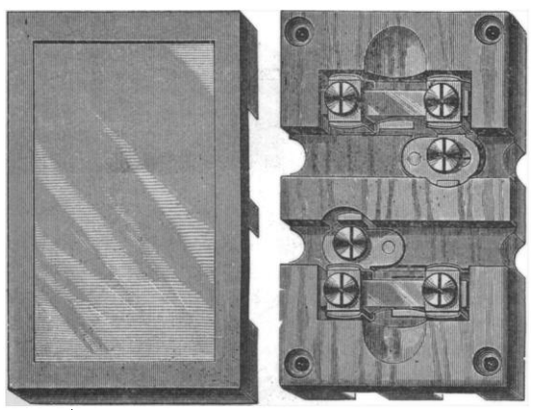


FIG. 12.

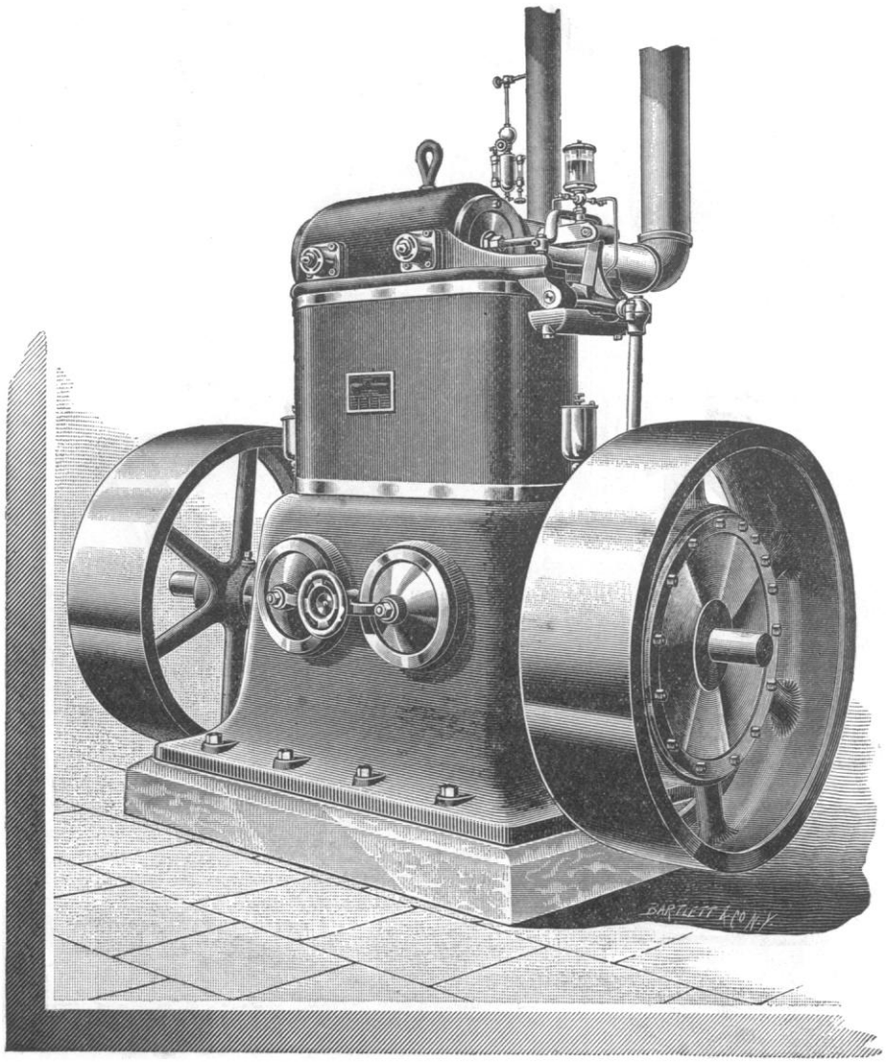
Fig. 12 represents a double pole branch-block.

WE learn from *Nature* that Dr. Schweinfurth arrived at Aden on March 23, on his return from a three months' stay in Central South Arabia. He has started for Europe, taking a very interesting botanical collection with him.

THE WESTINGHOUSE COMPOUND ENGINE.

THE American public is probably now fully prepared to accept compounding as the one and only road to the highest fuel economy in steam-engines. Compounding is almost universal among European manufacturers, extending down to engines of the smallest size, and has been forced upon them by the close margin of manufacturing profit there obtaining. The larger profits and freer methods which have ruled in this country, and particularly the great complication and prohibitive cost which follow the compounding of the ordinary automatic engine, have led to the almost universal adoption of the single cylinder.

It is not proposed to enter into a treatise upon compounding.



WESTINGHOUSE COMPOUND ENGINE, FRONT VIEW.

Every one knows that to compound an engine a second cylinder of three or four times the piston area is added, called the low-pressure cylinder, into which the exhaust steam of the first or high-pressure cylinder, instead of being thrown away, is passed, and made to yield a further amount of work. The additional work thus obtained is roughly proportional to the mean effective pressure in the low-pressure cylinder, multiplied by the difference in area of the two pistons. By this means the power of the engine is increased, and the steam, when finally exhausted, is at a pressure so low that less unused work remains in it. The maximum possibilities of economy are thus secured. But why cannot the same result be reached by further expansion in a single cylinder? A single cylinder, in the performance of its work, must choose between the two horns of a dilemma.

It has been found in practice that there is a certain load which is the most economical in a single cylinder. If the load increases, the terminal pressure increases; which means, that, when the steam is finally thrown away, it still has in it, say, twenty pounds of available pressure above the atmosphere, or thirty-two pounds above effective vacuum, which is a dead waste that ought to be preserved, and converted into work. If, now, we seek to lower the terminal pressure in order to waste less exhaust pressure, we not only cut down the power of the engine enormously, but at once introduce the element of excessive internal condensation in the cylinder, — a most insidious and fatal enemy of economy. Internal condensation is due to the fact that the immediate internal surfaces of the cylinder, cylinder-heads, and piston, are subjected at each stroke to a wide fluctuation of temperature, ranging from, say 330°, the temperature of the steam admitted from the boiler, to 212°, the temperature of the exhaust. The earlier the cut-off, the lower the terminal pressure and corresponding temperature, and the greater the amount of steam required to re-heat the surfaces: hence the greater the condensation. Hence any considerable departure in either direction from the rated power of a single-cylinder engine means a sacrifice of economy, — waste of exhaust pressure if overload, and loss from condensation if under-load. The compound engine, therefore, economizes by getting additional work out of the exhaust steam, which would otherwise be wasted; and by dividing the fluctuations of temperature between two cylinders, compelling one-half the variation to take place in each cylinder, thereby reducing internal condensation in the ratio of the squares, namely, to one-quarter of that due to a single cylinder.

For the Westinghouse compound engine, figures of which illustrate this article, it is claimed that it not only exceeds the economical performance of any single-cylinder engine, but of any other

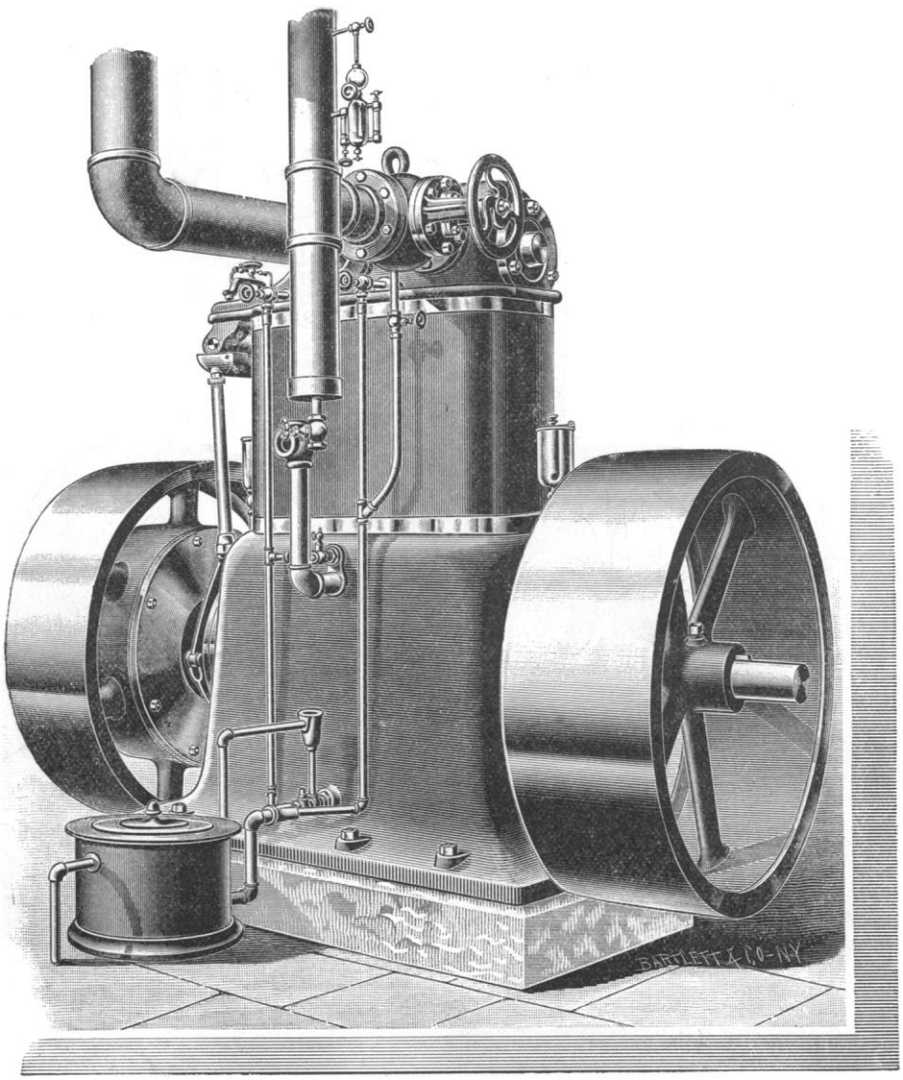
compound engine, size for size, as well. In explanation of this, it is said that it is a high-speed compound engine, the high rotative speed tending to economy of steam by using it quick and using it hot, and to that extent reducing condensation.

Again, the relative position of the two single-acting cylinders, with the cranks opposite instead of at right angles, gets rid at once of an intermediate receiver, and the consequent loss by free expansion due to exhausting from the high-pressure cylinder into the partially emptied receiver at each stroke, which is inseparable from other forms of construction.

But more important than any other factor of economy is the almost theoretical perfection of the steam-distribution. This is the more interesting from the fact that the first step in the design of the compound engine was the laying-out and perfecting of a theoretical diagram on the lines of maximum efficiency, upon which diagram the relative volumes and the valve functions were schemed. This is the reverse of the usual process; but the results, it is claimed, were most conspicuous in their success.

The governing idea in the design is a compound engine in which the functions of admission, cut-off, exhaust, and compression on both the high and low pressure cylinders shall be effected by a single valve, in which intermediate reduction of pressure without corresponding production of useful work shall be obviated, and in which substantially uniform compression to the full initial pressure shall be effected in the high-pressure cylinder, under all variations of load and boiler-pressure, and for all points of cut-off. Such a distribution of steam is theoretically perfect, and has been considered impossible in practice.

Both practice and theory have demonstrated as a necessity to secure the maximum economy of steam, not only that exhaust compression shall exist, but that it shall be raised exactly to the initial pressure of the incoming steam at the commencement of the stroke. We say exactly, since over-compression is equivalent to non-productive load in any other form; and, still more serious, under-compression fails to restore heat to the cylinder surfaces, besides leaving the clearance volume to be filled at the expense of live steam. This is true in general of any type of engine. It is therefore necessary not only that mechanism should be provided for effecting the full initial compression above indicated, but also that this mechanism, while still maintaining compression exactly to the initial, should at the same time possess the capacity of varying its effort, in order to meet each and every variation of load and pressure under which the engine may from moment to moment be operated. Such a capacity, or the attainment of such a result, constitutes the peculiar feature of the single-acting compound engine on which the Westinghouse Company rests its claims of superior economy.

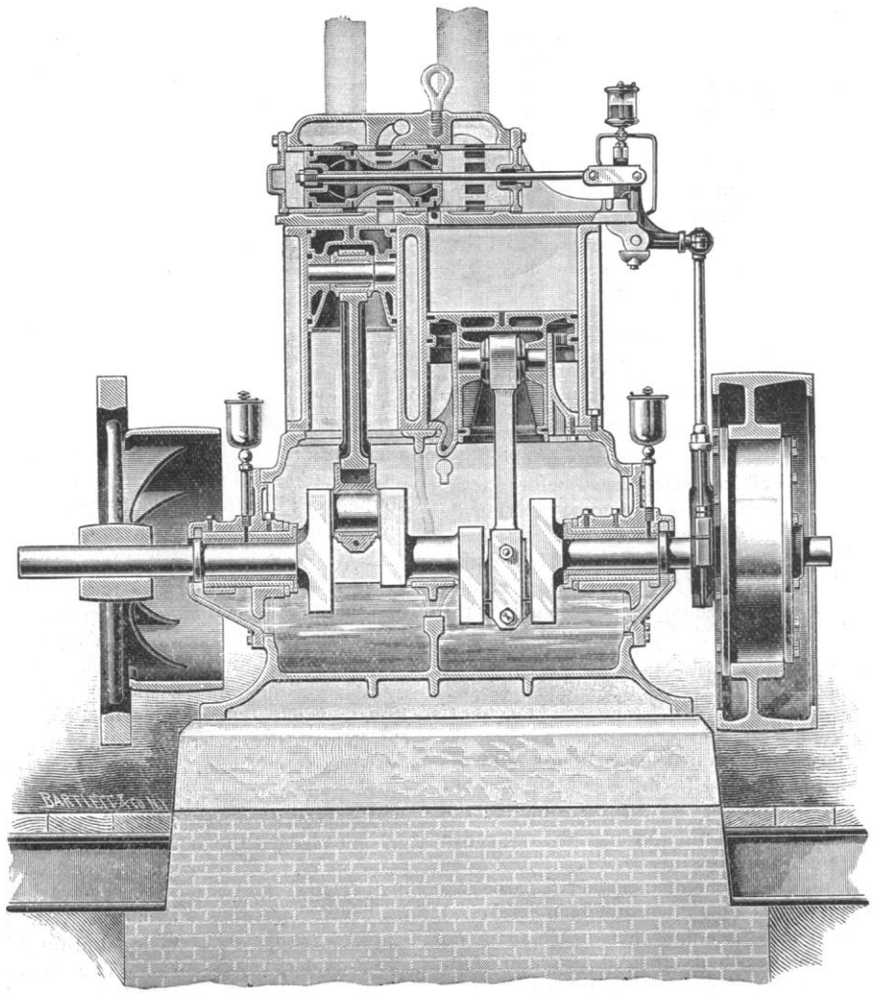


WESTINGHOUSE COMPOUND ENGINE, REAR VIEW.

In general form, the compound engine more nearly resembles their Junior engine. The mechanical characteristics of the single-acting engine are retained in every particular. One cylinder is enlarged to practically three and a half times the area of the other. The valve-chest is across the top of the cylinders, being the construction which admits of the least possible clearance in the low-pressure cylinder. The valve-chest is in one piece, the various steam-passages being chambered in it. The valve-seat is in the form of a bush, in which the ports are cut, not cast, to an exact register. This

bushing is reamed out, and forced steam-tight into its bored seat. This form of construction has many advantages. The casting is greatly simplified, avoiding all chances of porousness, sand-holes, and other defects which are liable to cause concealed leaks. The valve-seat can be made perfect, and the parts registered exactly, on which latter fact depends the perfection of the steam-distribution, and the consequent economy of the engine; and, lastly, the valve-seat can be easily and cheaply renewed when worn.

The valve-chest also contains a small by-pass valve controlling a cored passage, by which live steam can be admitted to the low-pressure cylinder, to turn the engine over its centre when starting. The steam and exhaust connections are on the side of the valve-chest towards the back of the engine, bringing the throttle-valve



WESTINGHOUSE COMPOUND ENGINE, LONGITUDINAL SECTION.

into convenient position, and admitting of the ready removal of the valve-chest when desired.

NOTES AND NEWS.

F. M. WEBSTER, Purdue University, La Fayette, Ind., in a letter to the United States Entomological Bureau, Dec. 23, 1887, states that some two or three years previous samples of various substances used for insecticides were placed in the Agricultural Museum of Purdue University, at La Fayette, Ind. As the object was merely to display the substances, they were placed in glass flasks, such as are used for similar displays of seeds, the mouth being in the base when the flask is in an upright position. One of these flasks contained several ounces of powdered white hellebore, which, as it was never disturbed, had settled into a somewhat compact body. On removing this flask a few days later, the cork stopper was found to have been burrowed through, evidently from without, and the mass of powder was literally full of burrows and channels passing through it in all directions. On turning the powder out upon a table, and examining it carefully, two adult beetles of *Tenebrioides mauritanica* were found dead in the burrows in the powder. How long these beetles had remained in the powder alive, it is obviously impossible to state; but it would be safe to say that they entered it from motives of choice, and either subsisted upon it, or else did an incredible amount of tunnelling without sustenance. While at the time the beetles were removed from the powder the latter was not fresh, and did not retain its full strength, there still remained enough to impart a tingling, burning sensation to the nostrils when any of the powder was inhaled through the nose, yet not enough to set one to sneezing.

— In Germany, for some years past, according to the *Journal of the Society of Arts*, London, efforts have been made, and with considerable success, to acclimatize the oak silkworms of China and Japan (*Attacus Pernyi* and *Attacus Yama-mai*). They have been raised in the open air, protected from the attacks of birds by nets of gauze or wire, changed from place to place as the oak-leaves are consumed. Late frosts and excessively dry weather have been injurious in depriving the worms of food. In California a new wild silk-moth, before unknown, has been found thriving on the poisonous species of *Rhamnus Californicus* or *R. Purshianus*. It produces a silk as good as that of the domesticated *Bombyx*. Owing to the favorable nature of the climate, without the frosts or rains of China and Japan, great hopes are obtained of propagating this species. In Yucatan a wild moth has also been met with, somewhat allied to the mulberry-worm, which produces silk of a bluish tint; but the gum which envelops it is difficult to remove. Mr. John MacIntyre, a recent traveller in Manchuria, records having met with several new species of silkworm, which he describes in the *Chinese Times*. One wild worm feeds on the *Pinus chinensis*. It forms handsome cocoons, which yield a strong silk; but they are so mixed up with the needle-like leaves of the pine, that the

winding-off of the silk would be difficult. On the walnuts he found another, which forms a reticulated cocoon, like a Chinese lantern. He also met with two other species of mulberry-worms—one very hardy, which could be fed on lettuce or dandelion leaves, and remains stationary; and another which moves easily from branch to branch in search of food. The rearing of *Attacus orizaba* of Mexico is to be attempted in France.

— The United States Entomological Bureau announces that Brood VIII. of the periodical cicada, which is of the seventeen-year race, will appear this year through quite an extent of country. The region commences in south-eastern Massachusetts, extends south across Long Island and along the Atlantic coast of New Jersey, Delaware, and Maryland as far as Chesapeake Bay; then up the Susquehanna River in Pennsylvania to a point a little below Harrisburg; thence westward in Ohio, embracing the south-western corner of the State and the north-western portion of Kentucky; and then upward through south-western Indiana, ending in central Illinois. It is possible, also, that there is an eastward extension of the region from Kentucky into southern West Virginia, as cicadas occurred in 1855 in the Kanawha valley, and also in the counties of Buncombe and McDowell, in North Carolina; but, as these appearances were not verified in 1872, it is probable that they belong to Brood XVIII., which is of the thirteen-year race. The bureau will be glad to receive full accounts this year of all appearances from any of their correspondents, and from all others who will be kind enough to write them of occurrences in their vicinity. Accounts from North Carolina and West Virginia are especially desired, as these will tend to clear up any doubt remaining as to what brood occurred in those States in 1855.

— Professor H. B. Gale, in a paper on a new theory of chimney-draught and the design of brick and iron stacks, read before the St. Louis Engineers' Club, stated that he had made numerous experiments to determine the different factors which entered into the problem, and gave some formulæ in shape for convenient use. He showed, that, while the area of a stack could not be reduced below certain limits, it could be increased without affecting the efficiency of the stack.

— President Frederick Augustus Porter Barnard of Columbia College died April 27, aged eighty years. He was born May 5, 1809, at Sheffield, Berkshire County, Mass.

— A very curious race, possessing no little interest for students of natural history, and which is vouched for by our English contemporary *Knowledge*, was recently witnessed in Westphalia, the contest being between pigeons and a number of bees, the respective owners of which had wagered their favorites to win. The course was three miles and a half, that being the distance between the two villages of Rhynern and Hamme; and a dovecot which happened to be near a hive was selected as the winning-post. It was found no easy matter to mark the bees so as to make their identity unmistakable, but the difficulty was at last surmounted by rolling them in flour previous to starting them on their journey. This, while making them easily recognized on their arrival, probably retarded their flight; but nevertheless, and though the pigeons were looked upon by those interested as the most likely winners, the race resulted in a victory for the bees; the first bee arriving at the post twenty-five seconds before the first pigeon, and three other bees before the second.

— It is generally conceded that for best results in butter-making, where the milk is set in deep cans, the milk should be placed in the creamer as nearly as possible at the temperature at which it is drawn from the cow; there being a considerable loss of fat in skim-milk if the milk is allowed to cool to any great extent before being set. Of late there has been considerable controversy as to whether it is advisable under any conditions to warm the milk before setting, and as to the limit of temperature beyond which it is not safe to go. Mr. I. P. Roberts concludes, as the result of investigations at the College of Agriculture at Cornell University, that, first, there is a loss of butter when the milk is allowed to cool much below the normal heat of the cow before being put into the creamer; second, while there may not be any very great increase of butter when the milk is heated, there is no risk of injuring the quality of the butter by incorporating an excess of caseine, even when the milk is heated as high as 135°.

— At a meeting of the Massachusetts Classical and High School Teachers' Association, April 5–6, President Eliot suggested an argument against admission to college on teachers' certificates, that has the interest of novelty. A college that admits pupils from a number of schools on certificates puts all such schools on a level, and denies to them the opportunity of special distinction. A principal who knows that his school is superior to certain others cannot publish this fact, and win his due applause, unless his pupils come into competition with the pupils of the other schools in admission examinations. According to *The Academy*, President Eliot cited the instance of a high-school principal in New York, who, disheartened at his inability to show his public that his school was a superior one, gave up teaching and went into business.

— The removal of tattoo-marks is a matter of no little difficulty, says *Nature*, and many different methods have been tried, — blistering, suction, thermo-cautery, counter-tattooing with white powder or milk, etc. Criminals sometimes pour vitriol on their arms or hands, and, letting it act for a few seconds, plunge the limb in water. The following method is recommended by M. Variot, in the *Revue Scientifique:* The skin is first covered with a concentrated solution of tannin, and re-tattooed with this in the parts to be cleared. Then an ordinary nitrate of silver crayon is rubbed over these parts, which become black by formation of tannate of silver in the superficial layer of the dermis. Tannin-powder is sprinkled on the surface several times a day for some days to dry it. A dark crust forms, which loses color in three or four days, and in a fortnight or so comes away, leaving a reddish scar free of tattoo-marks, and in a few months little noticeable. It is well to do the work in patches about the size of a five-franc piece at a time. The person can then go on with his usual occupation.

— At a public meeting held at Channing Hall in Boston, Dec. 13, 1887, an association was formed for the purpose of assisting the Pundita Ramabai in her plans for the education of child-widows in India. The Pundita's purpose and her plans for the proposed school, told in her own simple manner, were listened to by a large and enthusiastic audience. Addresses were made by Rev. Dr. E. E. Hale, Rev. Dr. Phillips Brooks, Rev. George A. Gordon, and Rev. Dr. F. Courtney. They urged upon all to assist this unselfish woman, who is working for the uplifting of her unfortunate countrywomen. A constitution, embodying the methods of the association, was adopted, and officers were elected. Many present pledged the annual payment of sums varying from one to ten dollars, for ten years. Several scholarships, of one hundred dollars annually for ten years, have been secured, and donations for a building-fund are being received. It is estimated that $25,000 will be needed for purchasing and furnishing a suitable building to accommodate fifty pupils. The annual payment of $5,000 will meet the current expenses of the school, and contributions, however small, will be gratefully received. Choice English literature, with other instructive and useful books, for a school library, will be acceptable. In order to raise the funds needed for starting and sustaining the work suggested by Ramabai, her friends have organized in different places "Ramabai Circles," pledging themselves to give annually, for the space of ten years, a certain fixed sum of money. These circles will communicate with, and transmit their contributions to, The Ramabai Association of Boston. The trustees of the Ramabai Association will keep themselves informed of the progress and effectiveness of the work in India, and no steps will be taken or remittances made except subject to their judgment. A careful consideration of the difficulties of the situation in India has led to the conviction that a school-building is indispensable. In addition to the unjustly high rent that would be demanded for a building for a school for women, there may arise, through the prejudice of the Hindus against women's education, many other difficulties. The landlord may, at any time he pleases, ask the school to leave the place; and the disturbance of its daily routine, the inconvenience and loss caused by such moving about, would be incalculable. It is therefore best that it have a building of its own. Even the hire of a building, for such a purpose, must

in ten years cost at least $10,000: the sum of $25,000 will provide permanently a handsome building (furniture and all), which will accommodate about fifty persons. The Ramabai Association, with its headquarters in Boston, has the following officers: president, Rev. Edward E. Hale, D.D.; vice-presidents, Rev. Phillips Brooks, D.D., Rev. George A. Gordon, Miss Frances E. Willard, Mrs. Mary Hemenway, Dean Rachel L. Bodley, M.D.; treasurer, Mr. T. Jefferson Coolidge, jun.; advisory board of India, Dr. Ramakrishna G. Bhandarkar, Rao Bahadur M. Ranade, Rao Saheb Deshmukh; corresponding secretary, Miss A. P. Granger, Canandaigua, N.Y. At a meeting held March 14, 1888, The Ramabai Circle of New York was organized, with the following officers: president, Mrs. Courtlandt Palmer; secretary, Miss L. S. Chambers; treasurer, Mr. Richard A. Anthony.

— Hengst's powder, as we learn from the *Engineering and Mining Journal*, is manufactured from straw properly prepared and chemically treated, and finally converted into a gunpowder of granular form. Its special use lies in the direction of military and sporting purposes, although in its compressed form it will probably be found applicable to blasting operations, inasmuch as, weight for weight, it possesses about 150 per cent greater strength than gunpowder, and it appears to be impossible to explode it by concussion. Its action, however, is more rapid and local than that of gunpowder, so that a greatly reduced charge only is required to produce results equal to those produced by that explosive. But, notwithstanding the rapidity of its action, so far as present investigation has gone, it would appear to be peculiarly suitable for the two main purposes which Mr. Hengst had in view when inventing it; namely, military and sporting. In order to test the merits of the powder, a series of trials was recently carried out by Mr. Perry F. Nursey, C.E., at the testing ranges of Messrs. Cogswell & Harrison, at Harrow. The experiments were made comparative with black powder, and in the trials having reference to military use the government pattern Martini-Henry rifle and ammunition were used. The charge in the case of the black powder was 85 grains, as against 35 grains of Hengst's powder, all other details remaining the same. Considering that the latter powder was only produced experimentally and in small quantities, the results were very satisfactory. The velocities, which were taken by chronograph, appear to have been a little lower and a little less uniform than those of the black powder. As regards smokelessness, flamelessness, non-heating, and non-fouling with the Hengst powder, these points appear, says *Iron*, to have been set at rest by Mr. Nursey's experiments. Smoke there was none, says that gentleman's report; only a puff of light vapor (carbonic gas), which rapidly condensed and disappeared from sight. Flame there was none, so far as the eye could detect in a darkened rifle range, only a faint pale-blue glow being visible at each discharge. Fouling there was none, in the ordinary sense of the word, while a number of rounds fired in rapid succession failed to do more than warm the barrel. An equal number of rounds of black powder similarly fired from the same rifle, cold, heated it considerably. As regards the nature of the report, it appears that in every case there was distinctly less noise with the Hengst than with the black powder.

— The work of cutting through the Isthmus of Corinth is reported by *The Builder* to suffer under the same financial difficulties as the Panama Canal work. A German technical journal states that when the subscription was opened for the carrying-out of the scheme in 1882, estimated to cost thirty million francs, and to be finished in six years, the money was subscribed five times over. In 1887, however, this sum had been expended, and a further sum of thirty million francs was invited. However, up to the present, only a third of this sum has been obtained, and, if no further funds can be obtained, the work on the canal will soon have to be stopped. Hitherto about two-thirds of the earthworks have been executed, but there still remains a great deal to be done; and it is now stated, that, as the canal will cost twice as much as originally estimated, no profits can be anticipated.

— At the monthly meeting of the Royal Meteorological Society, on April 17, the following papers were read: "On the Deaths caused by Lightning in England and Wales from 1852 to 1880, as recorded in the Returns of the Registrar-General," by Inspector-Gen. R. Lawson, LL.D. The total number of deaths from lightning during the twenty-nine years amounted to 546, of which 442 were of males, and 104 of females. In consequence of their greater exposure, the inhabitants of rural districts suffer more from lightning than those of towns. It appears, also, that vicinity to the west and south coasts reduces the chances of injury by lightning, and that distance from the coast and high land seems to increase them. "The Diurnal Range of the Barometer in Great Britain and Ireland," by Mr. F. C. Bayard, F. R. Met. Soc. The author has reduced the hourly records of the barometer at the nine observatories, Aberdeen, Armagh, Bidston, Falmouth, Glasgow, Greenwich, Kew, Stonyhurst, and Valencia, during the years 1876–80. The curves of inland places are smoother than those of places on the seacoast, and the curves of places to the westward are more irregular than those of places to the eastward. As we go from south to north, the general tendency of the curve is to get flatter with a lessened diurnal range. "Note on a Working Model of the Gulf Stream," by Mr. R. W. Clayden, M.A., F. R. Met. Soc. The author showed this interesting model at work. It has been constructed to illustrate the formation of ocean-currents in general, and of the Gulf Stream in particular. "On the Rime Frost of Jan. 6 and 7, 1889," by Mr. C. B. Plowright, F.L.S. The author gives an account of the very heavy rime which occurred in the neighborhood of King's Lynn on these days, when the fringe of crystals upon twigs and branches of trees was about two inches in length. The weight was so great that nearly all the telegraph-wires were snapped, and an immense number of branches of trees broken off.

— We regret to have to record the death of Mr. Warren De la Rue, F.R.S. He was born in 1815, according to *Nature*, and died on Good Friday, after a short illness from pneumonia. Mr. De la Rue was a most devoted observer and munificent patron of astronomy, and in him and Balfour Stewart solar physics has lost its chief founders.

— During the past few years, much attention has been given to the subject of economy in heating greenhouses, and the manufacturers of steam-heating apparatus have made great efforts to supplant the long-established system of hot-water heating. In order to get some facts in regard to this subject, so important to the grower of plants under glass, and gain some positive knowledge as to the relative value of the two systems, two houses were constructed at the Massachusetts Agricultural College, Amherst, Mass., during the summer of 1888, 75 by 18 feet, as nearly alike as possible in every particular. Two boilers of the same pattern and make (F. W. Foster, manufacturer, 51 Charlestown Street, Boston, Mass.) were put in, — one fitted for steam, and one for hot water (the steam, for heating the east house; and hot water, for the west and most exposed one). The boilers were completed and ready for work in November, and were tested until Jan. 9, 1889, when these experiments began. Records of the temperature of each house were made at 7.30 and at 9 A.M., and 3, 6, and 9 P.M. Sufficient coal was weighed out each morning for the day's consumption, and the balance not consumed deducted the next morning. The two boilers and fittings were put in so as to cost the same sum, and were warranted to heat the rooms satisfactorily in the coldest weather. As far as could be determined by close examination and weighing, there was about the same proportion of unconsumed coal as of that consumed in the ashes from each boiler. The hot-water boiler consumed 720 pounds less coal than the steam-boiler in February, and 688 pounds less in January, — a saving of nearly 20 per cent. At the same time the temperature of the room heated by hot water averaged 1.7° higher than that heated by steam. The temperature was more even where heated by hot water, and consequently there was less danger from sudden cold weather. This was strikingly shown on the night of Feb. 22. The average outside temperature for the day was 34°. At 9 P.M. it was above 32°, and, proper precautions not having been taken for so sudden a change as followed, at 6 o'clock on the morning of the 23d the temperature of the room heated by steam was 29°, while in that heated by hot water it was 35°. While this test is conclusive for the two boilers employed in these two houses as constructed, and for this unusual winter, in a larger house, and in a

winter where the temperature runs lower and with greater extremes, different results might possibly be obtained; but this can only be settled by carefully made and accurately recorded tests, which it is hoped may be made another year.

— The death is announced in *Nature* of April 25, of Dr. Paul du Bois-Reymond, professor of mathematics at the Technical High School of Berlin, and formerly at the Universities of Freiburg and Tübingen. He was the author of two well-known mathematical works, and brother of the eminent physiologist of the same name. He was born on Dec. 2, 1831, and died at Freiburg in Baden on April 7.

— A Chinese native paper published recently, says *Nature*, a collection of some zoölogical myths of that country, a few of which are worth noting. In Shan-si there is a bird which can divest itself of its feathers and become a woman. At Twan-sin-chow dwells the Wan-mu Niao (mother of mosquitoes), a fish-eating bird, from whose mouth issue swarms of mosquitoes when it cries. Yung-chow has its stone-swallow, which flies during wind and rain, and in fine weather turns to stone again. Another bird when killed gives much oil to the hunter, and when the skin is thrown into the water it becomes a living bird again. With regard to animals, few are so useful as the "Jih-kih" ox, found in Kansuh, from which large pieces of flesh are cut for meat, and grow again in a single day. The merman of the Southern Seas can weave a kind of silky fabric which keeps a house cool in summer if hung up in one of the rooms. The tears of this merman are pearls. A large hermit-crab is attended by a little shrimp which lives in the stomach of its master. If the shrimp is successful in its depredations, the crab flourishes, but the latter dies if the shrimp does not return from his daily excursions. The "Ho-lo" is a fish having one head and ten bodies. The myths about snakes are the strangest of all. Thus the square snake of Kwangsi has the power of throwing an inky fluid when attacked, which kills its assailants at once. Another snake can divide itself up into twelve pieces; and each piece, if touched by a man, will instantly generate a head and fangs at each end. The calling-snake asks a traveller, "Where are you from, and whither are you bound?" If he answers, the snake follows him for miles, and, entering the hotel where he is sleeping, raises a fearful stench. The hotel proprietor, however, guards against this by putting a centipede in a box under the pillow; and, when the snake gives forth the evil odor, the centipede is let out, and, flying at the snake, instantly kills him with a bite. The fat of this snake, which grows to a great size, makes oil for lamps, and produces a flame which cannot be blown out. In Burmah and Cochin-China is a snake which has, in the female sex, a face like a pretty girl, with two feet growing under the neck, each with five fingers, exactly like the fingers of a human hand. The male is green in color, and has a long beard: it will kill a tiger, but a fox is more than a match for it.

— Besides the usual attractions for the spring and summer, the excursion committee of the Appalachian Club has arranged for a club camping trip for August. The camp will be on Student Island in Mooselucmaguntic Lake, the largest of the Rangeley chain. Capt. Fred C. Barker, who owns and runs the steamers on this lake and leases Student Island, will accommodate the party, engaging a man and his wife to have special charge of the camp and to do the cooking. The party will have the use of a frame cottage, in which a few persons can be accommodated; but, as the excursion is arranged to please people who love camping, it is expected that the majority will sleep in tents. Camp-life, boating, canoeing, bathing, fishing, steamer excursions on the lakes, tramps in the forest, and ascents of Bald and Deer Mountains, will be attractions. It will be possible for members to arrange small parties, engage special guides, and make trips to Parmachenee Lake, Aziscohos Mountain, or other points of interest in the Androscoggin region. The camp will be opened early in August, and continue open till the middle of September if desired.

— The Connecticut Agricultural Experiment Station calls attention of farmers and others to the fact that it has extended its field of investigation by the addition of a new department, for which a laboratory has been completed during the past winter, and equipped with the necessary books and apparatus for the study of fungi which are injurious to vegetation through the production of rusts, smuts, rots, mildews, blights, and similar diseases. A small greenhouse is attached to the building for winter experiments, which has been used since its completion for preliminary experiments to test the utility of certain methods of treating smut in onions, to which special attention will be given during the coming season. In order to obtain as much information as possible on this subject, questions have been prepared, and sent to numerous onion-growers; and any one who can give any information on the subject should send to Dr. Roland Thaxter, 27 Lincoln Street, New Haven, Conn., for a set of the questions.

— The director of the Hatch Experiment Station of the Massachusetts Agricultural College, Amherst, Mass., invites all who may have valuable or especially interesting new varieties of fruits, vegetables, trees, shrubs, or flowers, to send them to him, that they may be tested side by side, and under the same conditions, with other new and the standard older varieties. The situation of this experiment station is now such that the best of attention will be given to all such new varieties, and careful observation and unprejudiced reports made of their behavior and merits. He would urge that especial attention be given to promising local seedling apples that have not been propagated and disseminated. On almost every farm may be found numerous chance seedlings; and, as most of the standard varieties now in cultivation have originated in this way, all seedlings that have the valuable qualities of size, beauty, flavor, vigor, and freedom from disease, should be further tested.

— Attention is called by *Building* to the advantages of wire-wove waterproof roofing. The Architectural Building Trades Exhibition, just closed in London, offered an opportunity to show its numerous applications. It is intended mainly as a substitute for galvanized iron in building. The roofing sheets are less than half the weight of twenty-four gauge corrugated iron, and, being composed of stout papier-maché, with fine steel-wire foundations, they are excellent non-conductors of heat and cold. A settler's hut, 14 feet by 10 feet, weighing little over half a ton, was exhibited. It was a strong, and at the same time a picturesque building, with overhanging eaves, snow-white walls, and tile-red roof. Many of these huts have been sent to the South African gold-fields, and other places where portability is important.

— Clark University, Worcester, Mass., has issued a preliminary announcement of the work of the university, to begin in October next, in the departments of mathematics, physics, chemistry, biology, and psychology, with such additional facilities for the study of languages as scientific students may require. This preliminary limitation of the wide academic field indicates no bias and no restriction of ulterior plans, but is adopted in the interests of more effective organization. It is intended that these departments shall be gradually organized and sustained on the highest plane possible in existing conditions. No distinctively undergraduate classes will be formed, and no candidate for lower college classes will be received at first. While not declining to confer the degree of A. B., the university will, for the present, give special attention to qualifying for higher degrees. Ten fellowships of the first class of four hundred dollars each, ten fellowships of the second class of two hundred dollars each, and ten scholarships with free tuition, have been provided. The rate of tuition has been fixed at two hundred dollars a year, exclusive of laboratory fees. Applications can now be received, and should be accompanied by a statement of the course of study, and, if possible, by a specimen of work. A prospectus containing fuller announcements will soon be issued.

— At a meeting of the Physiological Society, Berlin, March 27, according to *Nature*, Dr. Klemperer spoke on the proteid needs of the animal economy in health and in certain pathological conditions. Voit's teaching, that the human body in health requires daily from 100 to 120 grams of proteid in order to supply its nitrogenous needs, has been recently contested from many sides; and, even if the experiments on which the attacks were based were not altogether free from some defects, they still sufficed to cast a good deal of doubt on Voit's theory. The speaker had endeavored, working from the clinical point of view, to decide the question whether an increased proteid metabolism can be prevented or

diminished by an increased ingestion of carbohydrates or fats. He carried out experiments on the nutrition of two healthy persons, in which the daily dose of proteids was very considerably diminished, even down to 40 grams; while, in compensation for the lessened proteids, larger quantities of fats, sugar, and easily absorbed and oxidizable alcohol, were administered. The nitrogen excreted in the urine was constantly less in amount than that taken in the food, thus showing that healthy, active men can be fed with largely diminished amounts of proteid without the occurrence of any destructive metabolism of their tissue-proteids. He next proceeded to investigate whether, in diseases which are characterized by an abnormally large breaking-down of tissue-proteids, this increased nitrogenous metabolism could be lessened by the ingestion of an increased quantity of non-nitrogenous food. An increased nitrogenous metabolism occurs in dyspnœa, fever, anæmia, cancer, tuberculosis, diabetes, and Addison's disease. For dyspnœa, experiments were made on animals; while for anæmia, cancer, diabetes, and Addison's disease, observations were made on the human subject, and results were obtained which corresponded to the supposition under which the experiments were started. A very considerable reduction of the nitrogen excreted in the urine was observed when only moderate quantities of proteid were given, while at the same time increased amounts of carbohydrates, fats, and alcohol, were administered. It is impossible to enter here into the interesting details of these experiments, which were all carried out by very precise methods, or into a discussion of the hypotheses which were advanced in explanation of the phenomena which had been observed.

— The following are the dates of some of the international exhibition congresses which are to be held in Paris: technical education, July 8 to 12; bibliography of the exact sciences, July 16 to 26; chemistry, July 29 to Aug. 3; ballooning, July 31 to Aug. 3; pigeons, July 31 to Aug. 3; hygiene, Aug. 4 to 11; higher education, Aug. 5 to 10; physiological psychology, Aug. 5 to 10; geography, Aug. 6 to 11; photography, Aug. 10 to 17; criminal anthropology, Aug. 10 to 17; primary education, Aug. 11 to 19; horticulture, Aug. 16 to 21; prehistoric man and remains, Aug. 19 to 26; electricity, Aug. 24 to 31; chronometry, Sept. 2 to 9; mines and metallurgy, Sept. 2 to 11; applied mechanics, Sept. 16 to 21; meteorology, Sept. 19 to 25; river utilization, Sept. 22 to 27; commerce and industry, Sept. 22 to 28; and hydrology and Climatology, Sept. 30 to Oct. 15.

— M. Berthelot, at a meeting of the Paris Academy of Sciences, April 8, read a paper on the fixation of nitrogen by vegetable soil with or without the aid of leguminous plants. The paper deals with a fresh series of sixty-four methodic experiments carried out during the year 1888, and fully described in the April number of the *Annales de Chimie et de Physique*. They form a sequel to the systematic researches begun by the author in 1883, and tend fully to confirm the views already announced by him on the fixation of free nitrogen in the ground, effected either with or without the co-operation of luzern, vetches, and other leguminous plants. He considers the fixation now fully established, and finds in this fact the true interpretation of a multitude of phenomena highly important to agriculture. At the same meeting, M. J. Reiset described some experiments on putrefaction and the formation of manures. The more recent of these fully confirm the results of those undertaken by the author so far back as 1854, and show, that, in the process of organic decomposition, nitrogen is not fixed, but liberated.

— According to *Nature*, a series of regulations with regard to patents and designs has just been issued in Japan. All inventors whose discoveries are beneficial, or are calculated to improve existing processes of manufacture, may apply for letters patent. No patents, however, will be granted in the case of articles of food or drink, or in case of medicines. Inventors who do not receive letters patent are powerless to sue in respect of piracy of their inventions. In order to register an invention, application must be made to the Patents Bureau, and, if the officials are satisfied as to the genuineness of the invention, it is registered, on certain forms being complied with, and certain fees paid. A curious omission occurs in the regulations, but it is not plain whether it is intentional or not. Nothing whatever is said as to the rights of a foreigner to patent an invention, but it is presumed that he will not be able to do so, nor has any provision been made for advertising applications for letters patent. The Patents Bureau is to be the sole judge of all cases submitted to it, and from its decision there is no appeal; but in certain cases two judges sit with the bureau, and assist in deciding whether a patent should be granted or not. The duration of a patent is to be five, ten, or fifteen years, according to the amount paid in fees. The patent, of course, passes by assignment *inter vivos*, or to the patentee's heir, but nothing is provided for the cases of bankruptcy or marriage.

— *Nature* states in a recent issue, that, from a report of the Belgian consul-general in the Kongo State, it appears that the efforts made to introduce European vegetables and fruits in that district have been rewarded with very great success. The government has imported tobacco-seed from Havana and Sumatra, which is cultivated in conjunction with native tobacco. The natives cultivate tobacco badly, but efforts are being made by the government to teach them better methods. The inhabitants of the Lower Kongo have been very successful in cultivating not only the usual African products, such as manioc, sweet-potato, etc., but also sorghum, maize, and the "wandu" haricot, called "boma" by the natives. The cotton-plant grows in its wild state, and the natives manufacture from it hats, wallets, etc. No effort has yet been made to cultivate it for trade purposes.

— A carbohydrate of the empirical composition $C_6H_{10}O_5$, and possessing properties very closely resembling those of the arabin of "gum-arabic," has been artificially prepared by Professor Ballo of Buda-Pesth. This achievement, we learn from *Nature*, is the outcome of an attempt to reproduce the conditions under which the acids of the vegetable world are reduced by chlorophyl. It was assumed that the iron of chlorophyl is present in the ferrous state, and tartaric was the acid upon which operations were commenced. About equal quantities of tartaric acid and ferrous sulphate were dissolved in a minimum bulk of water, and the solution was warmed upon a water-bath. In a short time a grayish-yellow pricipitate began to separate. The whole was then evaporated until it completely solidified on cooling. The cold mass was next extracted with alcohol, and the extract again evaporated. The residue thus left by volatilization of the alcohol was neutralized with milk of lime, and the filtered solution again placed on the water-bath. It was now noticed, that, as the water was gradually expelled, the contents of the evaporating-dish became more and more viscid, until finally a sticky mass was left, reminding one most forcibly of gum-arabic. Knowing that this familiar article of commerce chiefly consisted of the calcium and potassium compounds of arabin, the likeness was felt to be somewhat indicative of the formation of an arabin-like substance. On allowing the concentrated sirup to cool, a calcium salt readily crystallized out, yielding, on analysis, numbers pointing to the formula $(C_6H_9O_5)_2Ca + 9H_2O$. From this the free carbohydrate was obtained in one of two ways, — either by precipitation of the solution in water with lead acetate and subsequent decomposition of the lead salt with sulphuretted hydrogen, or by addition of the calculated quantity of oxalic acid. The sirup of "iso-arabin," as it is provisionally termed, was further purified by repeated treatment with alcohol and ether, and subsequent re-evaporation. It was then allowed to stand over sulphuric acid, — some specimens for a month, and others so long as a whole year. Each of these specimens, on combustion, yielded numbers indicating the empirical formula $C_6H_{10}O_5$. Iso-arabin is an almost colorless sirup, readily mixing with water. It does not reduce Fehling's solution, but rotates the plane of polarization to the right. It behaves, in short, exactly like the carbohydrates of the $(C_6H_{10}O_5)_n$ group. The potassium salt obtained by decomposing the calcium salt with potassium carbonate also crystallizes well in large anhydrous crystals. In addition to iso-arabin itself, a small quantity of its hydrate $(C_6H_{10}O_5 + H_2O)$ is also formed by the action of ferrous sulphate upon tartaric acid, and separates out in crystals from the alcoholic washings of the crude iso-arabin. Natural arabin itself forms a similar hydrate; the precipitate formed by addition of hydrochloric acid and alcohol to a solution of gum-arabic, when dried at 100° C., possessing this composition.

SCIENCE:

A WEEKLY NEWSPAPER OF ALL THE ARTS AND SCIENCES.

PUBLISHED BY

N. D. C. HODGES,

47 LAFAYETTE PLACE, NEW YORK.

SUBSCRIPTIONS.—United States and Canada..... $3.50 a year.
Great Britain and Europe..... 4.50 a year.
Science Club-rates for the United States and Canada (in one remittance):

1 subscription	1 year	$ 3.50
2 "	1 year	6.00
3 "	1 year	8.00
4 "	1 year	10.00

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VOL. XIII. NEW YORK, MAY 10, 1889. No. 327.

CONTENTS:

THE FOLLOWING INSTANCE is reported to have occurred in Glasgow, and shows how easily measles may be spread. During the month of January, forty-two persons belonging to the congregation of a Gaelic church were taken ill with measles. Taking twelve to fourteen days as the recognized period of incubation, Dr. Russell, the health-officer, connects two serious groups of cases with the attendance at the church of two girls on Dec. 30 and Jan. 13 respectively. One of these girls, it is ascertained, had come from an infected house, while the other had actually taken the disease two days before. Two other girls who usually worshipped elsewhere, but were in this particular church on the 13th, became ill on the 26th, and other circumstances pointing in the same direction are noted. Dr. Russell considers, that, unless something like perfect isolation and disinfection can be guaranteed to a person who is suffering from infectious disease in a house, all healthy members of the household should be debarred from attendance at school, church, or other place of concourse.

THE AMERICAN DIALECT SOCIETY.

IN substance, the plan of this society is to collect and publish dialect material through an executive committee, with assistants in various places. The district secretaries will doubtless, after some experience, become more and more acquainted with the conditions and needs of their respective districts, and will thus be able to advise the executive committee with more confidence. The members of the executive committee will naturally assist in the direction of active members in their own States. Further, Professor Gustaf Karsten, Bloomington, Ind., will act as secretary for Indiana; Professor E. L. Walter, Ann Arbor, Mich., for Michigan; Professor Alcée Fortier, Tulane University, New Orleans, for Louisiana; Dr. James W. Bright, Johns Hopkins University, Baltimore, for Maryland; Mr. W. D. Armes, University of Calfornia, Berkeley, Cal., for California.

The conditions of membership have been made very easy in order to attract many members, for it is believed that the number of those who can contribute material in large or small amounts is very great. All who feel an interest in the plan of the society are invited to join it, even if they do not feel sure of contributing any thing but a membership fee. Without a large membership, the expense of printing will render publication only possible in small quantities or at long intervals. With a large membership, it will be possible to publish oftener, and to send the publications to every member without additional charge.

At the annual meetings it is not intended to have papers read. They are to be strictly business meetings, the work of publication being done through the executive committee and the editing committee. No regular issues can yet be announced, but it is hoped that it will be possible later to publish at stated intervals.

Some of the dialect variations indicated below are doubtless survivals of dialects spoken in England; others may be due to the influence of other European languages spoken in the United States and Canada, as French, German, Dutch, Spanish; while still others are probably independent developments in America. All are worth noting, and will have an attraction for linguistic students, perhaps all the greater when they appear to show the beginnings of dialectal divergence. The materials thus collected are not only interesting in themselves: they may be utilized in many ways, as in the construction of dialect maps to show how far each peculiarity extends, in comparisons with dialects in England and on the continent of Europe, in the preparation of a complete list of Americanisms, in assisting the work of lexicographers, and otherwise contributing to the history of the English language in America.

In order to give somewhat more in detail the purposes of the society, and the method of work planned by it, the dialect variations considered may be divided into two classes: —

I. VOCABULARY. — Strange, uncommon, or antiquated words, or uses of words, really current in any community. Such are *deedies* ("young fowls"), *gall* ("assurance, effrontery"), *to play hookey* or *to hook off* ("to play truant"), *to stump* or *to banter* ("to challenge"), *let the old cat die* (used of letting a swing come to rest gradually instead of stopping it), *slew* ("a great quantity"), *fool* (as an adjective), *he up and did it, he took and hit him, he's been and gone and done it, clim* or *clum* (*clomb*), *housen* (as plural of *house*), *the nagent* (for "the agent"), *sandy Pete* (for "centipede"), *to cut* or *to cut and run, to leg it, to buzz* a person (to talk with him), *buckle* ("to bend," used of ice under one's weight); likewise local names of fishes and plants, exclamations, and words used in games; also lack of common words or phrases which one would expect to find everywhere. It is the natural unstudied speech of different localities that is of interest. Many school-teachers might contribute lists of words and phrases which they perhaps have to teach their pupils not to use. Any person of education, especially if living in a different place from that where his childhood was passed, may also be able to make contributions. Even one such peculiarity found in common use where it has not already been noted has a value for the purposes of the society. Many such words and phrases have already been published in the collections of Americanisms, but much yet remains to be done in noting unrecorded usages, and in defining limits of use geographically and otherwise.

II. PRONUNCIATION. — For example, the different pronunciations of *r* in words like *hard, turn, cord, mother;* of *a* in *park, calm, past;* of *oo* and *u* in *room, rude, put;* of *o* in *stone, hot;* such forms as *git, ketch, shet* for *shut, sech* or *sich,* he *ken* or *kin* for *can, deestrict, holt* for *hold* (noun), *sneck* for *snake, hahmer* for *hammer,* etc. It is often possible to tell by a person's pronuncia-

tion from what part of the country he comes. For the study of pronunciation the received spelling is very ill adapted, and a phonetic system is needed if this part of the work is to be conducted in an intelligible manner. In the cases mentioned under I., where the pronunciation is of only secondary importance, such a system is not needed. It is necessary only where the pronunciation is the main thing to be noted, though it will be welcome whenever the pronunciation might be doubtful. A practical, though necessarily imperfect, system of phonetic spelling will be sent to any person who communicates with the secretary.

The officers of the society are, president, Francis J. Child, Cambridge, Mass.; vice-president, James M. Hart, Cincinnati, O.; secretary, Edward S. Sheldon, 27 Hurlbut Street, Cambridge, Mass.; treasurer, Charles H. Grandgent, Cambridge, Mass.; editing committee, the secretary *ex officio*, George L. Kittredge (Cambridge, Mass.), Sylvester Primer (Charleston, S.C.); executive committee, the officers named above, and Benjamin I. Wheeler (Ithaca, N.Y.), Charles F. Smith (Nashville, Tenn.), Frederic D. Allen (Cambridge, Mass.).

THE BOWER-BARFF RUSTLESS IRON PROCESSES.

THESE processes have for their object the protection of iron and steel from rusting. This result is obtained by the conversion of the surface of the metal into magnetic oxide of iron. The oxide is well known in its natural state as magnetic iron ore, which has withstood without deterioration or change centuries of exposure to the atmosphere and to fresh and salt water.

The Barff process consists essentially in subjecting to the action of superheated steam the articles which are to be rendered rust-proof. The treatment is carried out in a specially constructed furnace, and is more particularly applicable to wrought iron and highly finished and polished work.

The Bower process accomplishes the formation of magnetic oxide upon iron articles by subjecting them successively to the actions of highly heated air and carbonic-oxide gas derived from coal fires. The hot air converts the metallic surface into red oxide of iron, which is reduced to the black or magnetic oxide by the gas.

No foreign material, such as paint, alloy, or chemical of any kind, is applied to the metal; so that the coating is perfectly innocuous, and, owing to the simplicity of the process, its cost is less than that of galvanizing.

Surfaces of iron and steel treated by the Bower-Barff processes present a pleasing blue-gray or blue-black color, and preserve the sharp outline of artistic designs, while, if the articles are polished before treatment, the result of the oxidation is a lustrous, ebony-black finish.

The Bower-Barff processes have now a record of over four years in the United States, so that it is no longer necessary to refer to European practice for evidences of their value. In furnace construction, and other particulars, marked improvements have been made. Furnaces have already been established in the States of Pennsylvania, New Jersey, New York, Connecticut, Massachusetts, and Illinois, and others will shortly be erected.

The oxide process is applicable to all forms of cast, malleable, and wrought iron and steel, where the surfaces are not subjected to very severe friction, nor injured by subsequent manipulation. It is gradually supplanting the expensive and usually unsatisfactory galvanizing, and for ordinary culinary utensils is taking the place of tinning and enamelling. Where, for the sake of appearance, enamel is preferred, English manufacturers have adopted the process, because it is found that by first oxidizing the articles the enamel is rendered far more durable.

The demand by users of cast and wrought iron pipe for plumbing, drainage, gas, salt-works, steam-heating, and wherever it is desirable to protect pipes from rusting, is one of the most significant indications of the recognition of the value of the process.

The following brief review of the processes, in their leading features and recent developments, may serve to show how readily they can be adapted through a very extended range of iron manufactures.

The conversion of the surface of metallic iron into magnetic oxide of iron is carried out in a furnace. The articles to be treated, whether large or small, are loaded upon an iron drag, and shoved into a fire-brick chamber, known as the oxidizing-chamber of the furnace. Gas-producers, which constitute a part of the furnace structure, generate carbonic-oxide gas from a thick bed of coal upon the producer-grates. This gas is burned by an admixture of air in a combustion-flue beneath the oxidizing-chamber; and either the burning gases, or the hot products of combustion, according as the gas and air valves are regulated, enter through ports into the chamber, heating the charge, and then passing through exit ports to the chimney. After the goods have been raised by this means to the desired temperature, which may vary from an incipient red to a cherry heat, depending on the nature of the work, the treatment of the charge is begun. If the goods consist of castings, the Bower process of alternating oxidizing and reducing operations is generally employed. During the period of oxidation, the connection with the gas-producers is almost entirely cut off by a damper; and air, raised to a high temperature by passing through the hot combustion-flue above mentioned, enters the chamber and oxidizes the iron, converting its surface into the red oxide of iron (Fe_2O_3). After about forty minutes of this treatment, the admission of air to the furnace is stopped, and the producer-gases are allowed to pass for twenty minutes through the chamber without any admixture whatever. The chemical action of these gases upon the ironware results in a change or reduction of the superficial coating of red oxide of iron into the black or magnetic oxide ($Fe\ O_4$). The operations are repeated a number of times, so that the whole treatment lasts from ten to twenty hours, according to the thickness of the coating to be produced. At the end of the treatment the charge is withdrawn, and the furnace is then ready for treating another lot of ware.

The Barff process for wrought iron is carried out in the same furnace designed for the Bower treatment. The articles are charged and heated in the same manner as above; and, when the proper temperature is reached, highly superheated steam is introduced into the oxidizing-chamber, where a slight plenum, not exceeding one to two inches of water-pressure, is maintained for a period of ten to twenty hours. The steam from a half-inch pipe more than suffices for all the requirements. The superheating is easily effected by a continuous coil-pipe superheater, or by a couple of small intermittent superheating chambers, each filled with a loose checker-work of fire-brick, and forming part of the furnace structure.

The Bower or air process is the more economical one for the treatment of ordinary cast iron; whereas, for wrought and malleable iron, the Barff or steam process has been found more advantageous. Where wrought and cast iron work are combined, the Barff process is applicable. The steam treatment of the cast iron in such a case merely necessitates a longer period of exposure in the furnace than would suffice for producing the desired coating by the air process.

The mechanical finish of the iron, be this either wrought or cast, determines to a large extent the mode of treatment. Rough articles, from which the skin has not been removed, require for the formation of a proper coating in a given time higher heat and more energetic oxidation than goods whose surfaces are more or less finished. A high heat on a finished surface tends to blister and detach the magnetic oxide as it is formed. When articles, therefore, present some finished surfaces, and others which are rough, a comparatively low heat is used in the oxidizing-chamber, thereby precluding the possibility of injuring the surface; while the treatment is continued for a sufficient length of time to insure a thorough oxidation of the rough parts, even at the reduced temperature.

For the steam treatment of highly polished articles, a small muffle furnace is employed. The charge is heated by a flame which plays externally around the muffle. The increased expenditure of fuel thus incurred in heating the articles is more than compensated, in a furnace of small size, by the ease with which even a slight overheating of any portion of the polished goods is prevented.

The magnetic oxide coating is very hard, but comparatively inelastic. It withstands the wear due to friction, but is injured by blows of the hammer and rough usage. Wherever from this cause

the coating is chipped, the iron rusts, though the rust remains localized: it very rarely spreads or raises the coating, as is the common case with paint or electro-deposits.

The protection of the iron being due to a superficial layer of magnetic oxide, and not to any thing penetrating the metal (which would weaken it), it follows that any manipulation that would injure or destroy the continuity of the surface of the iron must necessarily prove destructive of the coating. In riveting, for example, the coating in the immediate neighborhood of the rivet-holes suffers; similarly, in driving nails through sheet-iron roofing, the oxide is chipped at the holes; in fitting "rustless" gas and steam pipe, it is injured by the bite of the wrench and vise, unless these are furnished with lead or copper cheeks; in shearing, it scales along the edge of the metal; and in flanging or bending sheet-iron, the coating on the line of the bend is cracked. The limit of elasticity of the oxide is practically the same as that of the iron: it adheres firmly to the metal under tensile and compressive strains until this limit has been reached, and no further.

A piece of "rustless" iron can be heated on a kitchen range and then plunged into cold water without the least scaling or other change; while coverings of paint, tin, galvanizing, and enamel suffer very much under such action. For this reason, "rustless" hollow ware is more readily cleaned than even enamel ware. The latter must be allowed to cool after use; and the remains of food in it become dried and congealed, and stick to the utensil, necessitating considerable scraping, and involving danger of injuring the enamel.

Magnetic oxide withstands the action of many brines, alkalies, sulphuretted gases, and weak, organic acids, but it is gradually dissolved by sulphuric and hydrochloric and other powerful acids. The corroding action of these acids, however, is considerably retarded on "rustless" iron, and hence such iron has been successfully used in chemical works where it was exposed to strong acid fumes. Coated articles have been exposed for years, without the slightest deterioration, to sea-water and to the most varied atmospheric conditions.

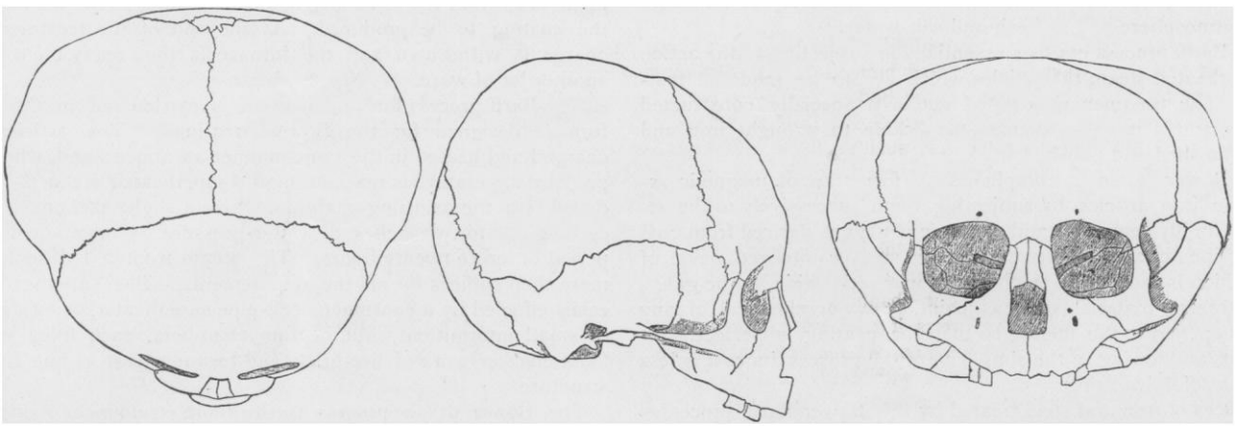

FIG. 1.—ORTHOGONAL VIEWS OF INFANTILE SKULL FROM COWICHAN, B.C.

ETHNOLOGY.

Notes from British Columbia.

IN 1879 Mr. Wardman, an intelligent reporter, accompanied the United States revenue cruiser "Rush" on her trip to Alaska, and described his experiences in a number of interesting letters to the Pittsburgh *Dispatch*. Some of his observations are well worth being rescued from the obscurity of a local paper.

He gives an interesting description of the Haida medicine-man: "The Indian doctor of the coast is an awfully mysterious personage. His first steps in the art of healing, according to the traditions of his tribe, are taken at an extremely early day in his career. Should a child be born with curly hair, a strabismical eye, or distorted limbs, he is accepted as a healer of coming generations, and all his early training is carefully conducted with a view to increasing his supernatural powers, and control over the spirits of the air. His food is carefully selected, and many articles of every-day use among the common herd are carefully excluded from his bill of fare. He is put in training for a doctor from his infancy, and great things are expected of him when fully developed and endowed with his degree.

"The doctor seldom washes his person, and never cuts his hair, which grows long and bushy in masses, knotted from want of combing, and entangled with burrs and general rubbish, such as floats around an Indian encampment. He adorns his scanty raiment with eagle's down, and altogether presents a weird, not to say untidy appearance.

"In cases of serious illness among members of the tribe, the eastern medicine-man will administer sparingly some pulverized herbs and teas in considerable draughts; but the Haida doctor of the Queen Charlotte Islands scorns all sublunary aids, powders or lotions. When an Indian is very sick, the doctor proceeds slowly at first to agitate his attendant spirit, which is called 'Yēk' (in the Tlingit language), and, by extraordinary contortions and severe gymnastic exercises, succeeds, in the course of half an hour, in working himself up into a perfect paroxysm of clairvoyancy, throwing off his garments as he progresses, till finally he stands arrayed in a Lydia Thompson skirt about his loins, but is otherwise clothed in foam and perspiration. Then he is ready for business.

"He then makes 'passes' toward the body of the patient, inhaling powerfully through his teeth. Having sucked the disease out of the form of the sick man, the doctor proceeds to the centre of the house, and blows it out up the opening where smoke from the fire finds its exit. Of course, the patient is now in a fair way to recovery. But, in case the patient does not evince any signs of improvement, the doctor finds that the 'conditions are not favorable' owing to the influence of some witch who has evoked an evil spirit to operate against the recovery. In such a case it becomes the doctor's first duty to point out the witch, who is stripped, bound, and subjected to a perfectly puritanical course of torture, with a view of forcing a confession. The rack, the scourge, and starvation finally have the desired effect, and the witch acknowledges any thing that the doctor demands. This is always gratifying, and is considered one of the greatest triumphs of the healing art; but, should the confession be made too late to effect the desired cure, the witch may be killed, and generally is sacrificed on general principles. Even though the patient dies under these circumstances, it is still a triumph for the doctor, as killing the witch is as good a proof of witchcraft in Alaska to-day as it was in New England two hundred years ago.

"The Haida, as well as other Indians of the north-west coast,

own slaves, and have owned them since the memory of man runneth not to the contrary. The original stock of slaves generally consisted of children captured in warfare, whose posterity remain in a condition of bondage. Slaves have been sold by these more northern tribes to the Indians of Puget Sound; and the power over such chattels has been so complete that they have been killed out of compliment to or regard for a dying master, and the women have been leased out for even worse purposes. When a chief dies, it is supposed he will need servants in the felicitous fishing-fields, and that the best way to secure them is to take them with him.

"The records of the Hudson Bay Company at Post Simpson show that in 1842, on one occasion, the agent visited a dying man of some note, and entered the place where he lay just in time to find him engaged in an attempt to strangle his nephew. The agent rescued the boy, and took him into the post, where he was kept till after the departure of the spirit of his kingly uncle. Then the mother of the lad demanded compensation of the company for the annoyance and inconvenience to which her departed brother would be put in the other world by reason of not having the attendance of the spirit of her son, murdered, upon his ghostly majesty. The company paid for that interference in a strictly family affair."

The writer also witnessed a cremation, which he describes as follows: "We were hardly at anchor yesterday [at Sitka] before we were informed that a body was to be cremated. The funeral pyre consisted of a crib of dried logs, about six inches in diameter and six feet in length, arranged four on the ground and three upon each side, supported by green stakes.

"The arrangements were very simple. The body of a woman who had died three days previous was hoisted out of the smoke-hole in the centre of the house. Dead bodies are never permitted to go out through the doorway among these Indians. The body was wrapped in a common bark mat, such as these Indians make, and laid in the crib, the top and ends being closed with logs laid crosswise. The fire was then started; and the mourners, who consisted of female relatives, sat around upon the ground to the windward, and slightly to the right of the burning pile. Their hair had been cut short, their faces were all blackened, and, as the tears from their weeping eyes cut channels through the lamp-black, the effect was rather ludicrous, if grief can be ludicrous under any circumstances. The women, who numbered fifteen or twenty, sobbed, sniffled, and whined with every evidence of genuine grief. This is mentioned because it is the custom here for Indians to hire professional mourners who officiate at the 'wake,'— an important affair among the natives.

"To the left of the women, a number of male relatives of the deceased put in the time chanting continually, and keeping time with staffs about five feet long, which they raised and dropped upon pieces of board so as to produce a rapping noise. The men stood erect all this time, and were led by an old man who held a crow-frog totem in one hand, which, being shaken, produced a rattling noise, owing to pebbles being within the hollow instrument.

"The ceremony continued for about three hours and a half, when the remains were consumed, with the exception of some of the larger leg and arm bones and a portion of the skull. As soon as the residuum was cool enough to be taken up, the mass, along with some wood-ashes, was placed in a box, which was deposited in a small sort of hencoop on stakes, scores of which dot the hill behind the village. After the cremation, the tired Indians turned in and slept during the afternoon, and at night had their customary dance in honor of the successful issue of the enterprise."

DEFORMATION OF HEADS IN BRITISH COLUMBIA. — It is well known that many tribes of the north-west coast of America are in the habit of deforming the heads of their children. It is an interesting fact that the "fashion" of deformation is distinct in various localities. Thus it becomes possible to distinguish natives from different parts of the country readily by the artificially acquired shape of their heads. In British Columbia three methods of head-deformation are in use. The tribes inhabiting the north point of Vancouver Island compress their heads, particularly those of female children, by means of bandages, the head thus acquiring an extremely long, almost conical shape, the vertex being pushed far back. Farther south the head is compressed between cushions of cedar-bark. The remarkable form resulting from this procedure is shown in Fig. 1. The marked depression behind the coronal suture indicates the place where a bandage passes over the head. In many instances the heads of adults, by this procedure, attain an enormous width, being wider than they are long. The third shape of head results from the application of a strong pressure on the forehead and occiput, which are compressed between boards. Fig. 2 shows the head of a male adult. It will be seen that the forehead and occiput are perfectly flat. The second method frequently results in extremely asymmetric forms, the parietal bones bulging out very strongly. It is a noteworthy fact that in the majority of cases the left side of the head is more prominent than the right side. Presumably this is due to the fact that the child mostly lies on his right side when in the cradle. In Fig. 1, a well-developed Wormian bone is seen. These are of frequent occurrence in the deformed crania, while the true *Os Incæ* is observed not rarely. Anomalies of persistence or premature synosteosis of suture are characteristic of these crania. The frontal suture is often persistent, while in a few instances the sagittal suture was found closed at an early age.

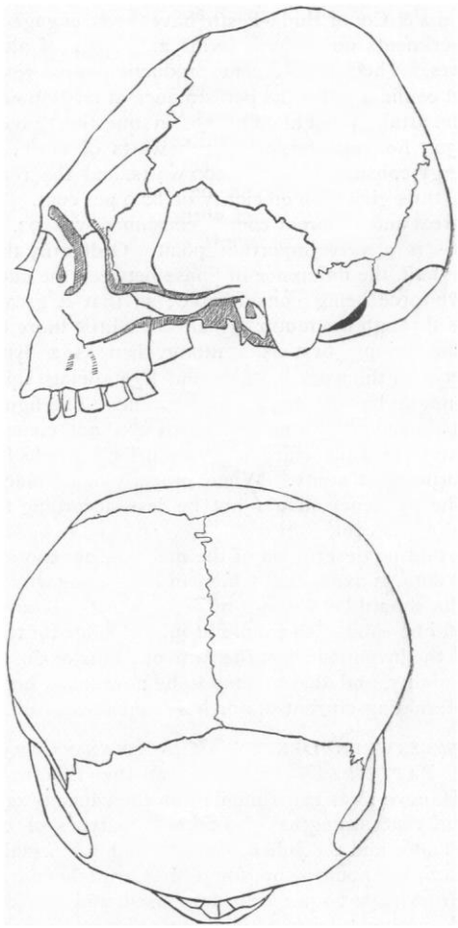

FIG. 2. — ORTHOGONAL VIEWS OF SKULL OF AN ADULT MALE, COWICHAN, B.C.

ELECTRICAL NEWS.

A New Alternating-Current Electro-Motor.

PROBABLY the two things most needed in the field of electrical engineering are a good storage-battery and a successful alternating-current electro-motor. A year ago, Mr. Tesla described an alternating-current motor before the Institute of Electrical Engineers, — a motor which it was promised would overcome all the defects and

difficulties which had seemed inherent to that type of apparatus. The Tesla motor is now controlled by the Westinghouse Electric Company, and that powerful organization has been exerting all of its energies to make the machine a success, but apparently to no great effect.

There comes from Europe, however, the account of a new motor, which, if we are to believe the figures given, accomplishes all that the Tesla motor promised; and while the latter required a special distributing system, using at least three wires to bring current to the motor, the new machine can be used in connection with the ordinary alternating system employed for incandescent lighting, and only two wires are necessary for the connections.

Messrs. Ganz & Co. of Buda-Pesth have been engaged for four years in experiments on various forms and types of alternating-current motors. Their most recent production gives results such that they feel confident that the performance of continuous-current motors will be attained. The machine in question gave, at 730 revolutions, 30.7 horse-power, or 22,700 watts of work, while the apparent energy consumed was 29,800 watts, and the real energy 27,700 watts, thus giving an efficiency of 80.9 per cent. The ratio between the real and apparent energy consumed was .92, or nearly unity, and this is a very important point. Ordinarily the ratio is less than one-half, the difference of phase between the current and electro-motive force being considerable; so that a great deal of current flows through the motor, which does little more than heat it, the machine running first as a motor, then as a dynamo, the difference between the work done on and by it being small, while the current might have a considerable value. The figures given above were obtained from a model, which was not constructed to give the greatest possible efficiency or output, but which was designed for purposes of study. When properly made machines are turned out, the efficiency should not be less, according to the designers, than 90 per cent.

It is a pity that no description of the machine, nor more accurate experimental data, is available. One can hardly see why such very meagre results should be sent out by the makers. If any thing is given, it should be enough to enable people to judge for themselves the merits of the invention; but the firm of Ganz & Co. is one of great respectability, and there seems to be now some hope that a successful alternating-current motor has been discovered.

RELATION BETWEEN DENSITY OF ACID AND CAPACITY IN SECONDARY BATTERIES. — M. Heim, at the Electro-technical Institute at Hanover, has experimented on the capacity of storage-cells with different strengths of acid. Two types of cells were used, — the Tudor and the Julien. These had a normal capacity of about 50 ampère hours; and, for a first experiment, acid of a strength of from 15 to 20 per cent was used, and the cells were charged and discharged three times, there being an interval of a day allowed between the charge and discharge. The next step was to fill the cells with acid of a strength of, say, 9 or 10 per cent, and again determine the capacity, there being always a number of discharges for each strength of acid, the discharge always lasting until the electro-motive force had fallen 10 per cent from its original value. The results obtained are, that the capacity increases rapidly with an increase of from 10 to 14 per cent in the strength of the acid; that it reaches a maximum at a strength of 16 per cent; then decreases slowly at first, and afterwards rapidly, as the density of the solution increases. M. Heim also made experiments to find out the strength of solution at which the support-plate begins to be attacked. He found that strengths even as low as 20 to 25 per cent were too concentrated, and, as the result of his work, recommends a density of 16 per cent (1.108). This is not so high as that ordinarily employed, the usual density varying from 1.150 to 1.200.

A NEW ARC-LAMP. — A new type of arc-lamp has been introduced into England from France by the Planet Electrical Engineering Company. The upper carbon is fed by means of an electric motor which drives a worm and a train of gearing. The field-magnets of the motor are in series with the arc, the armature being connected as a shunt to the field-magnets. The difference of potential at the two brushes of the motor is two volts. When the lamp is burning steadily, the motor is at rest; but, when the resistance of the arc increases, a solenoid core pulls down a lever, making contact to the armature, which immediately commences to revolve. Should the arc be made too short, the solenoid reverses the connections, and the armature revolves in the opposite direction. The advantage of the arrangement is, that there is plenty of power to overcome the friction of the slide, and that, with the exception of the solenoid, there are no fine adjustments.

QUARTZ AS AN INSULATOR. — At a recent meeting of the London Physical Society, Mr. C. V. Boys read a paper on the above subject, which is not without some practical interest. It will be remembered that Mr. Boys some time ago succeeded in obtaining extremely fine and strong fibres of quartz by shooting an arrow to which was attached a piece of quartz softened by heat. These fibres may be used instead of silk for delicate suspensions in electrical instruments. In making these fibres, Mr. Boys observed that if they were very fine, and broke between the bow and the target, the extremities assumed the form of a screw about half an inch in diameter and eight or ten inches long. If any body were brought near this screw, the end of it would shoot out toward it, retreating again when the body was removed. It hardly seemed possible to account for this in any other manner than by supposing the fibre to be electrified. If this were the case, it would show that quartz was an exceptionally good insulator, since ordinarily the exceedingly minute charge on the extremely slender fibre would be dissipated almost as soon as it was formed. Carrying his experiments further, Mr. Boys found, that while, even under any circumstances, quartz is a better insulator than glass, under ordinary atmospheric conditions there is no comparison between them. To show these insulating properties, a gold-leaf electroscope was made, the leaves being suspended by a quartz hook. In order to make the conditions as unfavorable as possible, a dish of water was placed in the case. After five hours, the deflection of the charged leaves had only decreased about a quarter. If glass had been substituted for the quartz, the leaves would have been completely discharged in considerably less than a minute. As quartz can be easily softened, and can be readily worked when soft, it should be of great value for electrostatic instruments, where there is always great trouble from leakage. Mr. Boys stated that even when quartz was dipped in ammonia, or boiled in potash, it only required washing to completely restore its insulating properties, and, even when it is raised to a red heat, these properties are recovered on cooling. Some quartz which was kept in fused potash for a considerable time lost its insulating properties to some extent; but, even after this treatment, it was better than glass.

HEALTH MATTERS.

VENTILATION. — The *Sanitary News* gives the following advice in reference to the admission of air to rooms: "Air should be introduced and removed at those parts of the room where it would not cause a sensible draught. Air flowing against the body at, or even somewhat above, the temperature of the air of the room, will cause an inconvenient draught, from the fact, that, as it removes the moisture of the body, it causes evaporation or a sensation of cold. Air should never, as a rule, be introduced at or close to the floor-level. The opening would be liable to be fouled with sweepings and dirt. The air, unless very much above the temperature of the air of the room, would produce a sensation of cold to the feet. It may be regarded as an axiom in ventilating and warming, that the feet should be kept warm and the head cool. The orifices at which air is admitted should be above the level of the heads of the persons occupying the room. The current of inflowing air should be directed toward the ceiling, and should either be as much subdivided as possible by means of numerous orifices, or be admitted through conical openings with the smaller opening toward the outer air and the larger openings toward the room, by which means the air of the entering current is very rapidly dispersed. Air admitted near the ceiling very soon ceases to exist as a distinct current, and will be found at a very short distance from the inlet to have mingled with the general mass of the air, and to have attained the temperature of the room, partly owing to the longer mass of air in the room with which the inflowing current mingles, partly to the action of gravity in cases where the inflowing air is colder than the air in the room."

CHOLERA TREATMENT. — Dr. Yvert, who claims to have had a large experience in the treatment of Asiatic cholera, reports that by the use of bichloride of mercury he has been able to reduce the mortality from 66 to 20 per cent. He also says, that, used as a prophylactic in those who have recently arrived in a region infected with cholera, it has in every instance warded off the disease.

YELLOW-FEVER IN FLORIDA. — From the best information we have been able to obtain, the reported case of yellow-fever at Sanford, Fla., was a true case. The patient, a Mrs. Dumont, wife of a boarding-house keeper, died April 20.

INSOMNIA. — Insomnia is an affection which is trying to both physician and patient alike, and many are the remedies which have been recommended for its cure. The latest of these is the peanut, eaten *ad libitum* just before retiring. A member of the clergy reports success with the peanut after having tried other means without result.

TOBACCO-SMOKING. — We have recently given the views of different physicians as to the effects of tobacco-smoking upon health, and have also referred to experiments bearing upon the question of the antiseptic power of tobacco-fumes. Additional evidence on these points is constantly accumulating. Dr. Hajek of Vienna has declared that smokers are less liable to diphtheria than non-smokers in the ratio of 1 to 2.8; and Dr. Schiff says that smoking is forbidden in the bacteriological laboratories, because it is known to hinder the development of bacteria in the various culture-media.

ACTION OF ELECTRIC LIGHT ON THE EYES. — A new disease, called photo-electric ophthalmia, is described as due to the continual action of the electric light on the eyes. The patient is wakened in the night by severe pain around the eye, accompanied with excessive secretion of tears. An oculist of Cronstadt is said to have had thirty patients thus affected under his care in the last ten years.

BOOK-REVIEWS.

Physiological Notes on Primary Education and the Study of Language. By MARY PUTNAM JACOBI, M.D. New York and London, Putnam. 12°. $1.

"IF literature were the business of life, or if, as was at one time supposed, education meant nothing else but acquaintance with literature, there would be some logic in the extraordinary prominence habitually assigned in education to the study of modes of expression. But from the modern standpoint, that education means such an unfolding of the faculties as shall put the mind into the widest and most effective relation with the entire world of things, spiritual and material, there is an exquisite absurdity in the time-honored method." Such is the opinion of the author; and such, we are glad to say, is the growing opinion of all observant men and women, except, perhaps, those whose observation is limited by the walls of their classrooms, and who do not discern the signs of the times. Dr. Jacobi gives us, in this book of but one hundred and twenty pages, the account of a most interesting personal experiment in primary education, in which a child was taught algebraic signs as a means of concisely expressing certain relations, long before any attempt was made to learn how to write. It would be interesting, did space permit, to follow in detail this experiment. By the time the child was four and a half years old, she had learned the following elements: straight, curved, slanting, and half-slanting lines; also to distinguish perpendicular and horizontal lines, and to draw either straight or curved lines parallel to each other. She was well acquainted with all forms of the triangle, the rectangle, square, trapezium, trapezoid, pentagon, hexagon, circle, and cube. When five years, the child was taught the equality of any two subjects which were demonstrably equal to the same third. And so the child went on to arithmetic, the meaning of words, and botany, before she was six years old.

The author discusses quite fully the place for the study of language in a curriculum of education. On this subject Dr. Jacobi says that it is necessary to maintain a just proportion between the study of languages and the other studies of a general curriculum. The effect on mental development and training is to be obtained, if at all, by the age of fourteen, fifteen, or sixteen. By this time the pupil requires the broader and more robust discipline of other knowledge, pursued with the thoroughness of scientific method which will then be practicable. It is undesirable to continue the systematic study of languages at this time (they should be dropped altogether); although the habit of reading in all may be most profitably kept up, and other subjects, especially history, studied through their medium. We must confess a great deal of surprise at some of the results which Dr. Jacobi reached in her experiment with the child already referred to. Had this child's accomplishments been reported to us in ordinary conversation, we should have regarded her as a phenomenon. But it is evident that her teacher believes that what was done with her could be done with the average child; and we have too much confidence in Dr. Jacobi to deny it without due consideration, yet would like to see the experiment carried out on a large scale before deciding that the plan was a feasible one. Having given no little attention to the study of languages, and knowing some of their difficulties, we are astonished to find the author stating that "one great reason for teaching children a reading acquaintance with four or five languages between the ages of eight and fourteen, is, that by the latter age they may really know these languages, and then begin to study something else, or of more immediate practical utility," as if a child could at the age of fourteen have a reading acquaintance with four or five languages, and really know them. We should be glad to learn that the opportunity had been given Dr. Jacobi to carry out her plan on a sufficiently extended scale to determine its practicability, for the results which she claims are certainly much to be desired.

AMONG THE PUBLISHERS.

GINN & CO. have just issued "A Vocabulary to the First Six Books of Homer's Iliad," by Professor Thomas D. Seymour of Yale College. It is claimed that a concise special vocabulary to the Homeric poems, or to parts of them, is open to far fewer objections than a similar vocabulary to any other work of Greek literature, since the words are found more nearly in their original significations and constructions. This vocabulary has not been compiled from other dictionaries, but has been made from the poem itself. The maker has endeavored to be concise, — to give nothing but what is important for the accurate and appreciative reading of the Iliad, — and yet to show the original and derived meanings of the words, and to suggest translations which should be both simple and dignified. A confident hope is felt that the concise form of this vocabulary will save much time for the beginner in Homer. More than twenty woodcuts, most of which are new in this country, illustrate the antiquities of the Iliad.

— *The Index of Current Events* (Montreal) was originally intended as a weekly for the use of editors only, and the amount of the annual subscription was decided upon with due regard to the comparatively limited possibilities in the way of circulation among the class it was intended to serve. It has since been suggested that an index of this character might have a much wider utility, and that in particular all those whose calling it is in any way to educate and mould public opinion would find such a publication of considerable service. *The Index of Current Events* is therefore offered at one dollar per annum, post free.

— T. Y. Crowell & Co. will publish soon George Brandes' "Impressions of Russia," in which are included chapters on Russian literature, which has been translated by Samuel C. Eastman of Concord, N.H., who spent last summer in Denmark, and worked under Brandes' supervision.

— Houghton, Mifflin, & Co. have nearly ready a collection of poems by Dr. S. Weir Mitchell, the eminent Philadelphia physician, entitled "The Cup of Youth," which will be published in shape similar to his former volume, "A New Year's Masque;" and a volume by Mrs. A. J. Woodman, a niece of the poet Whittier, entitled "Picturesque Alaska," giving an amusing account of experiences on a trip to Alaska, illustrated with photographs of the most

striking scenes at various points of the journey. Mr. Whittier has written an introduction to the volume.

— Ginn & Co. announce, in the Library of Anglo-Saxon Poetry, Vol. VI. "Cynewulf's Elene," edited by Charles W. Kent, M.A. The introduction of this work will contain an account of the manuscript, author, sources, theme of poem, etc., as well as a discussion of the versification, particularly of rhyme. The text is accompanied by the Latin original at the foot of each page. The notes, intended as aids to the student, will be full, and frequent reference will be made to Cook's Sievers' "Grammar."

— Mr. E. I. Brill of Leyden, Holland, announces the publication of J. Büttikofer's work on "Liberia," founded on investigations made in 1879–82 and 1886–87. At the present time, when the suppression of African slave-trade attracts so much attention, a study of the republic of Liberia will be very welcome to many readers, and Americans will be particularly interested in it on account of the enormous amount of labor and money devoted by our countrymen to the establishment and development of this republic. The author, who has devoted much of his time to studies on the natural history and ethnology of this country, gives a description of his journey, and sketches of life in the republic, as well as among the little-known aboriginal tribes. The illustrations are taken from photographs and sketches made by the author.

— Little, Brown, & Co. have now ready a volume entitled "The United States," by Professor J. D. Whitney. The volume is made up from the article written for the "Encyclopædia Britannica," modified in such a manner that it appears as originally written, with the facts and figures illustrating the physical geography of our country and its material resources, corrected down to the beginning of the present year. They have also just issued the index volume to the "Encyclopædia Britannica," completing the work.

— "Bell Hangers' Hand-Book," by F. B. Badt, is just the book for those engaged in selling, installing, or handling electric batteries, electric bells, elevator, house, or hotel annunciators, burglar or fire alarms, electric gas-lighting apparatus, electric heat-regulating apparatus, etc. It is said to be the only book of the kind, and is published by the Western Electric Company, Chicago.

— E. & F. N. Spon will issue shortly, "Sewerage and Land Drainage," by George E. Waring, jun., and announce as in press "A Theoretical and Practical Treatise on the Strength of Beams and Columns," in which the ultimate and the elastic limit strength of beams and columns is computed from the ultimate and elastic limit compressive and tensile strength of the materials, by means of formulas deduced from the correct and new theory of the transverse strength of materials, by R. H. Cousins. This firm further announces a "Treatise on Water-Supply, Drainage, and Sanitary Appliances of Residences: including Lifting Machinery, Lighting and Cooking Apparatus, etc.," by Frederick Colyer; and "The Voltaic Accumulator; an Elementary Treatise," by Emile Reynier, translated from the French by J. A. Berly, C.E.

LETTERS TO THE EDITOR.

***Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

The editor will be glad to publish any queries consonant with the character of the journal.

Twenty copies of the number containing his communication will be furnished free to any correspondent on request.

A New Mountain of the Bell.

I HAVE just returned from a journey of four weeks in the Desert of Mount Sinai, made with the especial object of studying the Jebel Nagous in connection with the joint researches of Dr. Alexis A. Julien and myself on musical sand. The "Mountain of the Bell" is situated on the Gulf of Suez, about four hours and a half from Tor by the roundabout camel-route. It was first described by Seetzen in 1808, since which time it has been visited by Ehrenberg, Gray, Wellstedt, Rüppell, Ward, Newbold, and the late Professor Palmer, as well as by large numbers of pilgrims. My observations confirm in the main their accounts of the acoustic phenomena heard, but my measurements differ widely from those of all the travellers save Professor Palmer,

The name "Jebel Nagous" is given by the Bedouins to a mountain, nearly three miles long and about 1,200 feet high, composed of white sandstone bearing quartz pebbles and veins. On the western and northern sides are several large banks of blown sand inclined at high angles. The sand on one of these slopes at the north-west end of the mountain has the property of yielding a deep resonance when it slides down the incline either from the force of the wind or by the action of man. This bank of sand I distinguished from the others by calling it the "Bell Slope." It is triangular in shape, and measures 260 feet across the base, 5 to 8 feet across the top, and is 391 feet long (high). It has the high inclination of 31° quite uniformly. It is bounded by vertical cliffs of sandstone, and is broken towards the base by projecting rocks of the same material. The sand is yellowish white, very fine, and possesses at this inclination a curious mobility, which causes it to flow, when disturbed, like molasses or soft pitch, the depression formed being filled in from above and advancing upward at the same time. The sand has none of the characteristics of sonorous sand found on beaches. When pulled downwards by the hands, or pushed with the feet, a strong vibration is felt, and a low note is plainly heard resembling the deep bass of an organ-pipe. The loudness and continuity of the note are related to the mass of sand moved, but I think that those who compare it to distant thunder exaggerate. The bordering rocky walls give a marked echo, which may have the effect of magnifying and prolonging the sounds, but which, as I afterwards ascertained, is not essential. There are no cavities for the sand to fall into, as erroneously reported. The peak of Jebel Nagous rises above the Bell Slope to the height of 955 feet above the sea-level, as determined by a sensitive aneroid.

After studying the locality and phenomenon for several days, I formed the opinion that it could not be unique, as hitherto supposed, and accordingly I tested every steep slope of blown sand met with on the caravan-route northward to Suez. On April 6 I examined a steep sand-bank on a hillock only 45 feet high, and was rewarded by the discovery of a second Nagous. This new Nagous is in the Wadi Werdan, only five minutes off the regular caravan-route, and one and a half days by camels from Suez. The hillock is called by the Bedouins "Ramadan," and forms the eastern end of a range of low hills about one-quarter of a mile long. Being the only hills in the Wadi, the locality can easily be found by travellers. The hills consist of conglomerate and sandstone, and towards the west of gypsum. They slope up gradually from the north, and end in bold cliffs on the south side. Sand blown by the north wind is carried over the cliffs, and rests on the steep face at two inclinations, — 31° above, and 21° or less below. By applying the usual tests with the hands to the fine-grained sand, I found, that, wherever it lies at the requisite angle to produce mobility (31°), it yielded the bass note, though not so loud as on the Bell Slope of Jebel Nagous. In one instance my friend and fellow-traveller, Henry A. Sim, Esq., of the Madras Civil Service, who kindly aided me in my investigations, heard the sound while standing 100 feet distant. The Nagous sand occurs at intervals throughout the quarter-mile of low cliffs; the main bank at the east end being 150 feet wide and 60 feet high, measured on the incline. I stirred up the sand pretty thoroughly on this slope, and the next day it failed to give the sounds, not having recovered its properties. The intervening night was very cold (53°).

I feel confident that this phenomenon is not very rare in the desert, though the spontaneous production of sounds by sliding of the sand without man's agency, as at Jebel Nagous, may be. Whether the Rig-i-Rawan north of Cabul is caused by similar conditions remains to be determined, but I am informed that the peculiar relations existing between England and Russia will prevent my visiting northern Afghanistan at present.

The Bedouins who accompanied us were greatly astounded at my discovery of a new Nagous, and I fear that their faith in a monastery hidden in the bowels of Jebel Nagous has received a severe shock.

It is interesting to note that the Nagous, or wooden gong, is in daily use in the monastery of St. Catherine, Mount Sinai. I photographed Jebel Nagous and vicinity, as well as my new Nagous, and collected specimens of the rocks, sand, etc. This is merely a preliminary notice, fuller details being reserved for the work on musical sand in preparation by Dr. Julien and myself. I shall be

obliged if those having opportunities of examining banks of dry and fine sand, inclined at 31°, in the arid regions of the West, will report through your columns whether they yield deep sounds when disturbed. H. CARRINGTON BOLTON.

Cairo, Egypt, April 10.

Rainfall and Latent Heat.

IT is probable that no element engaged in the increase of energy in storm-formation, according to ordinary theories, exceeds in importance that of heat set free in the condensation of vapor. Professor Espy was one of the first to enunciate this principle, and to insist upon its entire adequacy to account for all the phenomena even in the most violent tornadoes. Professor Ferrel has said, "Even if any part of the atmosphere should receive such an [primitive] impulse as to produce a most violent hurricane, friction would soon destroy all motion, and bring the atmosphere to rest. Hurricanes, then, and all ordinary storms, must begin and gradually increase in violence by the action of some constantly acting force. . . . This force may be furnished by the condensation of vapor ascending in the upward current in the middle of the hurricane, in accordance with Professor Espy's theory of storms and rains. According to this theory, all storms are produced by an ascending current of warmer atmosphere saturated with moisture, and this current is kept in motion by the continual rarefaction of the atmosphere above by means of the caloric given out of the vapor which is condensed as it ascends to colder regions above."

Professor Mohn gives this calculation of the effect of latent heat set free on Oct. 5, 6, and 7, 1844: "The Cuban hurricane has used for the moving of the air which was rushing in during those three days at least 473,500,000 horse-power; that is, at least fifteen times as much as all wind-mills, water-wheels, steam-engines, locomotives, man and animal power, on the whole earth produce in that time. Whence comes this immense power? From the latent heat of the vapors which rise in the middle of the hurricane, and are condensed during this process. A rainfall of one millimetre (.04 of an inch) per day on a circular surface eight geographical miles in radius would be sufficient to produce, by the liberating of the latent heat in the vapor, the force which the Cuban hurricane displayed in the air-cylinder mentioned above."

These examples will serve to show the views held by two of the most prominent writers on this subject. I have examined the writings of more than twelve scientists, and find that all, without exception, emphasize the importance of this effect. Diligent search has been made in all quarters for a quantitative determination of this effect, but without success. It has seemed of some importance to make a beginning at such analysis, even though, as will readily be seen, the subject is an exceedingly difficult one to elucidate. The following proposition is presented: —

There can be no considerable condensation from saturated air as long as latent heat is set free from it. A short computation will show that the condensation of a grain of water will set free enough latent heat to raise a cubic foot of saturated air about seven degrees in temperature. Let us imagine it to be possible to condense one-seventh of a grain of moisture out of a cubic foot of saturated air at 80° without changing its temperature: latent heat would immediately be set free, and would just re-evaporate the moisture. It would seem at first sight as though this would always be the result, and hence that no precipitation could ever occur without the intervention of some other force. At all events, the proposition above seems abundantly proved.

Suppose, however, that we try to abstract enough heat to lower the temperature one degree. We shall find, that after abstracting enough heat to lower the temperature one-third of a degree, and to condense .111 of a grain of moisture, the rest will be needed to balance the latent heat evolved by the condensation. We shall then have our air saturated at 79.7°, and a precipitation of .111 of a grain. It might be thought that this process could continue indefinitely, but this is not the fact. If we inquire how the above cooling has been possible, we find at once that it has been brought about by heating the surrounding air. I think we can best see this by imagining two cubic feet of air at 80°, side by side and yet distinct. Suppose that, instead of raising the surrounding air, all the heat abstracted in cooling the first cubic foot be passed into the second. We shall then have one cubic foot of saturated air at 79.7°, and another of unsaturated at over 80°. If, now, we mix these, we shall have two cubic feet of unsaturated air at over 80°, and this will need quite a cooling before any further precipitation.

Of course, in nature no such sudden transitions as these occur, but the principle seems to be the same in all cases. The results following such a process are far-reaching and most important, but there is no space here for dilating further upon the question. It seems to me, after a most careful study of the problem, that we have virtually, in an ascending current, an analogous effect to that in mixing two bodies of air at different temperatures. In the latter case it is admitted by all meteorologists that no considerable precipitation can ever occur. If this computation be true, we have a most important deduction, and have apparently wiped out at a single stroke one of the main-stays of theoretical meteorology as now taught. I confess to great diffidence in advancing this computation; but if it shall result in the development of the true principles involved, and a quantitative determination of the effects in many other theories now on an exceedingly unsubstantial basis, I shall be only too glad to be proved in error. H. A. HAZEN.

Washington, D.C., April 29.

"Alphabetic Law" and "World-English."

MR. MATTHEW MONROE CAMPBELL, a retired teacher, resident in Boulder, Col., has issued a series of open letters, advocating the official establishment of "Alphabetic Law" in the writing of English, under the direction of a government bureau. "Alphabetic Law," Mr. Campbell says, "requires (1) a single sign or letter for each sound; (2) a single sound for each sign or letter; (3) a joint name for each sign and its sound (its own sound must be the name for a letter); (4) to ortho-graph, or right-write a spoken word, is simply to change each sound in the word for a letter named after it; (5) to ortho-ep, or right-voice a written word, is simply to change each seen letter back to its unseen sound; a letter, then, cannot have two values, and a letter can never be silent, for a letter is a seen sound."

The idea of enforcing such principles, however excellent, in government printing, or by the authority of a State department, is not likely to meet with favor. The "Alphabetic Laws" are certainly good, so far as they go; and I would point out that they are strictly carried out in the scheme of "World-English." In the latter case, however, they are not proposed for adoption in common orthography, but merely for facilitating the acquirement and the world-wide diffusion of our language. Any thing like a proper and complete phoneticism of ordinary literature is not to be looked for in our day. ALEX. MELVILLE BELL.

Washington, D.C., May 7.

Ayrton and Perry's Secohmmeter.

SCIENCE of April 26 contains a description of Ayrton and Perry's secohmmeter, an instrument consisting of two commutators fixed on the same axle. In your article it is stated that an electrolytic cell will not polarize with rapidly alternating currents, and that consequently the secohmmeter may be employed to measure the resistance of electrolytes in a manner described. May I call your attention to a paper of mine, published in 1882 in the "Transactions of the Royal Society of Canada" (Sec. III. p. 21), in which this method of determining the resistance of electrolytes was, I think, first described? My experience in developing it showed that the electrodes of an electrolytic cell do become polarized, even with very rapidly alternating currents, and that consequently the method which is sketched in your article cannot be trusted to give accurate results. I found, however, that the double commutator, employed in the manner specified in your article, was useful as keeping the polarization at a very small value, and I was able to eliminate the error due to it in the measurement of resistance by introducing two electrolytic cells of the same section, but of different lengths, into two adjacent arms of the Wheatstone's bridge, an adjustable resistance being included also in the arm containing the smaller cell, and by making the other arms consist of wires of equal resistance. J. G. MACGREGOR.

Dalhousie College, Halifax, N.S., April 30.

Clintonite, or Seybertite?

THE first discovery of the mineral called by these names was in 1828, by Mr. J. Finch, Professor W. W. Mather, and Dr. William Horton, at Amity, Orange County, N.Y. It was named "clintonite" on the spot by the discoverers. Dr. Beck soon after examined it sufficiently to enable him to decide it to be a distinct species; but he made no publication of the fact at the time, though it was distributed to collectors under this name.

In the *American Journal of Science* (vol. xvi. 1829) it was described by Mr. Finch under the name of "bronzite," which he then thought it was; and, although no analysis is given, the description is complete in every other respect, and thoroughly identifies the mineral in question.

In the same journal (vol. xix. 1831, p. 169), in a report of the "Proceedings of the New York Lyceum of Natural History," the following sentence occurs: "Dr. Torrey presented bronzite (clintonite) from Orange County." There can be no doubt as to what mineral is meant.

Clemson, in the *Annales des Mines* (3d series, vol. ii. 1832), describes the same mineral, giving the first analysis, under the name "seybertite," after the well-known chemist, Henry Seybert. It was also called "chrysophan" by Breithaupt in the same year, and "holmsite" by Thomson in 1836.

In Beck's "Mineralogy of New York" (1842) there is a statement of the facts in the case, a claim of priority being made as follows: "The name 'clintonite' was given to it by the discoverers in honor of DeWitt Clinton; and, as all subsequent examinations have proved their opinion that it was a distinct species to have been correct, it seems to be proper that the name should be retained. It has been generally adopted by the German mineralogists, and those of New York certainly will not hesitate to follow the example." This conclusion was accepted, and the name generally adopted. Dana, who uses "seybertite" in 1837, changes to "clintonite" in his 1844 edition, and retains the name in those of 1850 and 1854. In the fifth edition (1868), after the name had held its place for more than twenty-five years, Dana goes back to "seybertite," because, as he says (p. 508), "Clemson's name "seybertite" . . . has therefore priority of publication, and must be accepted as the name of the species." In this he has been followed by most writers since, and "clintonite" has been placed in the list of synonymes.

But the fact is that "clintonite" was the name first given and first published; for the publication in 1831, quoted above, is earlier than that of any other name except "bronzite," which of course cannot stand, and indeed was not meant as a new name. Further, this name was in general use among dealers and collectors before Clemson's name appeared at all. It therefore seems right, and a matter of simple justice, to adopt the name "clintonite," under which indeed the mineral is best known, as the name of the species, thus honoring "our distinguished statesman, scholar, and man of science, DeWitt Clinton."

ALBERT H. CHESTER.

Hamilton College, Clinton, N.Y., April 29.

INDUSTRIAL NOTES.

The Thomson-Houston System in Boston.

THOSE in whose mind there still clings some doubt as to the reliability of the electric railway will find in the following report of the Cambridge Division of the West End Street Railway, Boston, figures, furnished by the Thomson-Houston Company, that prove conclusively that the electric railway can be depended upon. This road has a previous record of but 9 trips lost out of 1,179. The following report is for the month of April: average number of motors in daily service, 8; round trips of motor-cars, 2,720; time in service, motor-cars, 3,232 hours; mileage of motor-cars, 17,680 miles; round trips, one tow-car, 2,720; round trips, two tow-cars, 226; time in service, towed cars, 3,500 hours 30 minutes; mileage of towed cars, 19,149 miles; total car round trips, 5,666; total car mileage, 36,829 miles. Of the above round trips, but 7 were lost. In addition to the new contracts mentioned in the last issue, the Thomson-Houston Company has just contracted with the Naumkeag Street Railway Company of Salem, Mass., to supply them with 6 motor-trucks, each equipped with two 15-horse-power motors. They will be used on the line from Salem to the Willows. The company has also received an order from the East Harrisburg Passenger Railway for one double-motor truck, equipped with two 15-horse-power motors. Work is rapidly progressing on all the roads which the company has under contract, and very soon some of them will be put in operation. Work on the new line of the Revere Street Railway is being rapidly pushed toward completion. The piles are all driven, the cross-timbers put on, and the track is nearly all in place. The line is double-track, and will extend from Winthrop Junction to Crescent Beach, and may be continued beyond there on the tracks of the West End Street Railway Company of Boston.

Electric Railway at Atlantic City, N.J.

During the last week the Sprague Electric Railway at Atlantic City was started, and the operation of the road on the trial trip of the cars was perfectly successful; and the cars ran over the entire distance of the road at a speed exceeding fifteen miles an hour, towing another car behind them. A number of the officials of the road were present, and expressed great satisfaction at the operation of the cars, their ease at starting and in rounding the curves. The equipment of this road includes the new 15-horse-power motors of the Sprague Company, and all the latest devices and improvements in use by the Sprague Company upon their street-railways. This system of roads at Atlantic City, which is now being completely equipped with electricity, is controlled by the Pennsylvania Railroad Company. Before adopting any system upon this road, the officials of the railway company made a thorough investigation of all the systems of electric propulsion, both cable and electric, in use in all the cities of this country, and during the investigation, which lasted about five months, visited nearly all the cities in which there were electric railways in use. They were so thoroughly satisfied by this investigation that electricity is the most convenient and economical as well as reliable force for operating the street-cars, that they have given orders to cover the entire equipment at this place. It is estimated that the roads will carry very large numbers of passengers during the coming season.

More Street-Railways.

The coming of summer is heralded by the large number of street-railways which have decided to adopt electricity upon their roads. During the centennial week that has just passed, a number of railway companies have signed contracts for complete electrical equipments; and it is interesting to note that among these is one of the largest and most important street-railways in the important city of St. Louis, Mo. We understand from the Sprague Company that they have closed a contract during the past week with the Lindell Avenue Street Railway Company of St. Louis, Mo. This contract calls for 10 cars of 30 horse-power each, to be operated over 5 miles of track. The overhead system will be used, and the line covers some of the most noted and principal streets of that city. The contract of this company with the Sprague Company calls for a complete equipment, including dynamos and full station equipment. Another of these contracts is with the Wilkesbarre and Westside Railroad of Wilkesbarre, Penn. It will be remembered that the Wilkesbarre and Suburban Railway was one of the first to equip with electricity; and, since this road has been put in operation, its success has been so great that its management have ordered an additional number of cars. The installation of this second line in the same town with the other lines is a most gratifying indication of the success which electric railways have gained. This line will extend over 4 miles of track, and the equipment will include 3 complete Sprague cars, and all the latest attachments in use upon many of the Sprague roads. The Bay City Street Railway Company has also contracted for electrical apparatus during the past week, and this equipment calls for 3 cars and 5 miles of track. Before deciding upon any system, the Bay City (Mich.) Railway Company made an investigation of electric railways now in use, and visited a large number of cities in which there are electric railways in operation. As a result of this investigation, the contract was awarded to the Sprague Company.

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Carpentry and Building	1.00	4.25	2.25
Century Magazine	4.00	6.80	5.00
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Harper's Bazar	4.00	6.80	5.00
Harper's Magazine	4.00	6.80	5.00
Harper's Weekly	4.00	6.80	5.00
Harper's Young People	2.00	4.80	3.00
Health and Home	1.00	4.25	2.25
Herald of Health	1.00	4.25	2.25
Illustrated London News (Amer. reprint)	4.00	6.80	5.00
Independent, The	3.00	5.80	4.00
Inter Ocean, The	1.00	4.25	2.25
Iron Age (weekly)	4.50	7.30	5.50
Journal of Philology (Eng.)	2.50	5.30	3.50
Journal of Speculative Philosophy (begins with Jan. No.)	3.00	5.80	4.00
Judge	4.00	6.80	5.00
L'Art	12.00	14.80	13.00
Life	5.00	7.80	6.00
Lippincott's Magazine	3.00	5.80	4.00
Littell's Living Age	8.00	10.80	9.00
Little Men and Women	1.00	4.25	2.25
London Quarterly	4.00	6.80	5.00
Macmillan's Magazine	3.00	5.80	4.00
Magazine of American History	5.00	7.80	6.00
Medical and Surgical Journal	5.00	7.80	6.00
Mechanical Engineer	2.00	4.80	3.00
Metal Worker	1.00	4.25	2.25
Microscope, The	1.00	4.25	2.25
Nature	6.00	8.80	7.00
New Princeton Review	3.00	5.80	4.00
North American Review	5.00	7.80	6.00
Outing	3.00	5.80	4.00
Overland Monthly	4.00	6.80	5.00
Pansy	1.00	4.25	2.25
Political Science Quarterly	3.00	5.80	4.00
Popular Science Monthly	5.00	7.80	6.00
Popular Science News	1.00	4.25	2.25
Portfolio, The	7.50	10.30	8.50
Practitioner	3.50	6.30	4.50
Public Opinion	3.00	5.80	4.00
Puck	5.00	7.80	6.00
Puck (German)	5.00	7.80	6.00
Quarterly Review (London)	4.00	6.80	5.00
Queries	1.00	4.25	2.25
Rural New-Yorker	2.00	4.80	3.00
St. Nicholas	3.00	5.80	4.00
School Journal	2.50	5.30	3.50
Scientific American	3.00	5.80	4.00
Supplement	5.00	7.80	6.00
Architect and Builders' edition	2.50	5.30	3.50
Scribner's Magazine	3.00	5.80	4.00
Southern Cultivator	1.50	4.30	2.50
Springfield Republican (weekly)	1.00	4.25	2.25
Sunday School Times	2.00	4.80	3.00
Teachers' Institute	1.25	4.05	2.25
Texas Siftings	4.00	6.80	5.00
Trained Nurse	1.50	4.30	2.50
Treasure-Trove	1.00	4.25	2.25
Truth Seeker, The	3.00	5.80	4.00
Wide Awake	2.40	5.20	3.40
Young Folks' Journal	1.00	4.25	2.25

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